

Shirley Sullivan
6-5257 K.4
9/10/98

EPA Region 5 Records Ctr.



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LAGOON CLOSURE REMOVAL ACTION

VOLUME 3 - CONSTRUCTION DOCUMENTS

Commercial Oil Services Site
Oregon, Ohio

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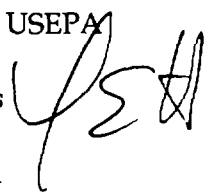


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MEMORANDUM

TO: Sheila Sullivan; USEPA
FROM: Terry Huntrods 
C.C.: Bill Baker; CRA
Dan Forlastro; Engineering Management Inc.
RE: **Volume 3 - Construction Documents**
Lagoon Closure Removal Action
Commercial Oil Services Site, Oregon, Ohio

REF. NO.: 5649-37

DATE: September 10, 1998

Please find attached a copy of the current Construction Documents for the Commercial Oil Services Site in Oregon, Ohio.

This Volume 3 of the Design Report replaces the previous copy and is the active document being used in the field.

An additional copy of the document has been forwarded to Bill Baker in our field office at the Site. Mr. Baker will ensure that the Tetrattech representative is provided with this copy also.

If you have any questions, please feel free to call me at 651-639-0913.

TEH/kjs/1

CONTRACT SPECIFICATIONS

LAGOON CLOSURE REMOVAL ACTION

**Commercial Oil Services Site
Oregon, Ohio**

Contract No. 5649 (13)

SEPTEMBER 1998

REF. NO. 5649 (13)

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CONESTOGA-ROVERS & ASSOCIATES

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SECTION 01010

SUMMARY OF WORK

1.1 SECTION INCLUDES

- A. Scope of work.
- B. Location.
- C. Access to Site.
- D. Description of work.
- E. Contract Schedule.
- F. Drawings.
- G. CONTRACTOR use of Site.
- H. Measurement and payment.

1.2 SCOPE OF WORK

- A. Works to be performed under this Contract consists of construction of a landfill; treatment of wastewaters; excavation and stabilization of approximately 50,000 cu yd of PCB-contaminated soils; final stabilization of approximately 60, 000 cu yd of partially stabilized sludges, excavation of contaminated soils; demolition and removal of a concrete block structure; and placement of all stabilized sludges, debris and contaminated soils into the landfill; capping and closure of the landfill; Site restoration; and associated work for Remedial Action.
- B. TRUST may delete any portion of Works from Contract. Deletion of any portion of Works from Contract shall not be basis for change to Contract Price other than for those Items deleted.

1.3 LOCATION

- A. Site is located at 3600 Cedar Point road in the southeastern corner of Otter Creek Road and Cedar Point Road in the City of Oregon, Lucas County, Ohio.

1.4 ACCESS TO SITE

- A. Access to the area is available from Cedar Point road.
- B. Make arrangements with the authorities having jurisdiction for the movement of material and equipment to and from Site over public roadways.

1.5 DESCRIPTION OF WORK

A. Work includes but is not limited to the following:

1. Mobilization and startup.
2. Development, implementation, and maintenance of a Site-specific Health and Safety Plan.
3. Site preparation for access to Works.
4. Provision, implementation and maintenance of construction facilities and temporary erosion and sediment controls. Temporary diversions of miscellaneous services are to be implemented and maintained by CONTRACTOR until full restoration of active work area is completed and approved by ENGINEER.
5. Construction of landfill consistent with TSCA liner and RCRA cap requirements.
6. Dewatering of standing water, infiltrating groundwater and surface water entering active work areas as set out in specifications.
7. Stabilization and excavation of approximately 50,000 cu yd of contaminated sludges and soils from the lagoons and excavation of contaminated soil not requiring stabilization from the lagoons and other areas.
8. Final stabilization of approximately 60,000 cu yd of partially stabilized sludge by drying or addition of reagents.
9. Construction of riprap areas as shown on Drawings.
10. Construction of manhole complete with cover.
11. Design, construction, and operation of a temporary Wastewater Treatment Facility at the landfill.
12. Discharge of treated wastewater to surface water at northeast corner of Site.
13. Placement of stabilized sludges and soils, contaminated soil and other debris in landfill.
14. Maintenance of chain link fences and gates.
15. Demolition of concrete block building and placement of debris in landfill.
16. Capping and closure of landfill.
17. Site restoration including seeding.
18. Demobilization and closeout.
19. Construction of clay test pad.

1.6 CONTRACT SCHEDULE

A. Perform Works in accordance with the following Contract Schedule:

1. Commence Works at Site within 14 days after the date of Notice to Proceed.
2. Conduct 24-hour Stabilization System Performance Test within 45 days after issuance of Notice to Proceed.

1.7 DRAWINGS

A. Drawings issued with and forming part of Contract Documents are listed below:

<i>Drawing No.</i>	<i>Rev. No.</i>	<i>Date of Drawing or Latest Revision</i>	<i>Title</i>
1	1	March 1998	Existing Conditions
2	2	March 1998	Site Work
3	2	March 1998	Site Preparation
4	1	March 1998	Containment Cell Bottom Layout
5	2	March 1998	Final Grading Plan
6	2	March 1998	Cross Sections
7	0	May 1996	Details
8	0	May 1996	Details
9	1	March 1998	Details

B. Perform Works in accordance with Drawings issued "Approved for Construction" by ENGINEER. Such Drawings will be issued to CONTRACTOR after Notice of Award and will consist of bid Drawings revised as required by ENGINEER and additional Drawings if required by ENGINEER.

C. Revised "Approved for Construction" Drawings may be issued from time to time by ENGINEER and such Drawings will supersede previous revisions.

D. If revised "Approved for Construction" Drawings are issued, which necessitate changes to CONTRACTOR's drawings not yet reviewed, no separate payment will be made for CONTRACTOR's expenses involved in revising such drawings.

1.8 CONTRACTOR USE OF SITE

A. Limit use of Site and premises to allow: work by TRUST and maintenance personnel who need to service equipment or services on Site.

B. Construction Operations: Limited to areas noted on Drawings. Do not unreasonably encumber Site with plant, equipment, or materials. Do not obstruct vehicle passage, use, or otherwise interfere with properties outside of Site unless otherwise specified.

C. Hours of Operation: Limit on-Site hours of operation to hours of 7 a.m. to 8 p.m., Monday to Saturday, except for maintenance of pumping and treatment systems which may proceed on an

as-necessary basis. Work during other hours may be performed with the approval of the ENGINEER.

- D. When unfavorable weather, soil, drainage, or other unsuitable construction conditions exist, continue operations which will not be adversely affected by such conditions. Do not construct or cause to be constructed any portion of Works under conditions which would adversely affect quality of Works, unless special means or precautions are taken to perform Works in proper and satisfactory manner. Work outside of the listed times may be performed upon approval by ENGINEER.

END OF SECTION

SECTION 01015
GENERAL REQUIREMENTS

1.1 SECTION INCLUDES

- A. Mobilization and startup.
- B. Superintendence.
- C. Related Sections.
- D. *Specification language.*
- E. Coordination.
- F. Field surveying.
- G. Site mobilization meeting.
- H. Progress meetings.
- I. Pre-installation meeting.
- J. Examination.
- K. Preparation.
- L. Restoration.
- M. Measurement and payment.

1.2 MOBILIZATION AND STARTUP

- A. Do not mobilize to Site without ENGINEER's prior written authorization. Ensure Bonds and insurance as required by Contract Documents are in full force.
- B. Perform planning and scheduling activities as required for the performance of Works.
- C. Purchase materials and mobilize equipment, supplies, and incidentals to Site.
- D. Use the existing Site access roads to the designated work areas during mobilization. Complete improvements to roads as required.
- E. Site temporary construction facilities in areas approved by ENGINEER. Obtain ENGINEER's approval prior to changing locations of temporary construction facilities. Do not use other areas without ENGINEER's prior approval. Provide additional land and access thereto not shown or described that may be required by CONTRACTOR for temporary construction facilities or storage of materials with no liability to TRUST or ENGINEER. Relocate construction equipment or other materials or equipment as required for the performance of Works.

- F. Do not commence work involving contact with potentially contaminated materials until decontamination facilities are operational and approved by ENGINEER.
- G. Furnish submittals as required and described in these Project Specifications.

1.3 SUPERINTENDENCE

- A. Provide necessary superintendence during execution of Works. Employ and assign to Works a competent and authorized representative satisfactory to TRUST herein referred to as Superintendent and who shall be responsible for supervision, inspection, and direction of Works and who shall be empowered to act on behalf of CONTRACTOR in all matters pertaining to Contract. All instructions given such representative by TRUST or ENGINEER shall be binding as if given to CONTRACTOR. Instructions will be confirmed by ENGINEER in writing upon request. Superintendent shall be constantly on Works at Site and give his whole time to the superintendence of same. Do not remove Superintendent from Works unless (i) TRUST requests removal, (ii) Superintendent ceases to be employed by CONTRACTOR, or (iii) otherwise agreed by TRUST and CONTRACTOR. If double shift work is necessary at Site, provide an assistant Superintendent to take charge of the second shift.

1.4 RELATED SECTIONS

- A. When related Sections are listed in individual Sections, other Sections of Project Specifications not referenced in the list of related Sections shall also apply to the extent required for the proper performance of Works.

1.5 SPECIFICATION LANGUAGE

- A. These Project Specifications are written in imperative mood and are in abbreviated or streamlined form and include incomplete sentences. This imperative language is directed to CONTRACTOR, unless specifically noted otherwise. Omission of words or phrases, such as "the CONTRACTOR shall", "shall be", "a", "the", and "all" are intentional. Omitted words or phrases shall be supplied by inference in the same manner as they are when a "note" occurs on Drawings.

1.6 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various Sections of Project Specifications and other requirements of Contract Documents to insure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Verify that utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- C. Coordinate space requirements and installation of mechanical and electrical work. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with

line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

- D. Coordinate completion and cleanup of work of separate Sections in preparation for Preliminary Acceptance of Works.
- E. After Preliminary Acceptance of Works, coordinate access to Site with ENGINEER for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of TRUST's activities.
- F. Provide advance notice of delivery of materials to Site as required in other Sections.
- G. Coordinate delivery of material and equipment to Site with work sequence; schedule deliveries to limit requirement for storage at Site to the practical minimum; limit on-Site storage of materials to areas approved by ENGINEER.

1.7 FIELD SURVEYING

- A. Unless otherwise specified, ENGINEER will establish reference bench marks and base lines adjacent to Works. CONTRACTOR shall be responsible for laying out Works from established reference points.
- B. Verify locations of survey control points prior to starting work. Promptly notify ENGINEER of any discrepancies discovered.
- C. Notify ENGINEER in writing at least 15 working days in advance of commencing work on any part of the construction to enable ENGINEER to establish bench marks and base lines.
- D. Locate, preserve, and protect survey control and reference points as set or established by ENGINEER. Promptly report to ENGINEER the loss or destruction of any reference point or relocation required because of changes in grades or other reasons. Make good any errors entering into Works through CONTRACTOR failure to notify ENGINEER concerning lack of preservation of such survey reference points. Accurately replace or relocate dislocated reference or survey control points based on original survey control by registered land surveyor. Make no changes without prior written notice to and approval of ENGINEER.
- E. Develop and make such additional detailed surveys as are needed for construction, such as bench marks, slope stakes, batterboards, stakes for establishing the design elevations of excavations and final grades, and other working points, lines, and elevations. Maintain bench marks and base lines established by ENGINEER or other existing property boundaries, lines and grade hubs, and other references and construction or survey points.
- F. ENGINEER may, at any time, check CONTRACTOR's survey and layout work but this shall not relieve CONTRACTOR of any of its responsibilities to carry out Works to the lines and grades as set out in accordance with Drawings and Project Specifications or as otherwise necessary for performance of Works in accordance with Contract Documents.
- G. Provide reasonable and necessary opportunities and facilities for setting points and making measurements during construction.

- H. Employ a land surveyor registered in State of Ohio and acceptable to ENGINEER to perform survey work.
- I. Control datum for survey is that shown on Drawings.
- J. Verify set-backs and easements, confirm Drawing dimensions and elevations. Maintain a complete and accurate log of control and survey work as it progresses.
- K. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.
- L. Establish a minimum of 2 additional permanent bench marks on Site, referenced to established control points. Record locations, with horizontal and vertical data, on Record Documents.

1.8 SITE MOBILIZATION MEETING

- A. ENGINEER will schedule and administer a Site mobilization meeting at Site prior to CONTRACTOR occupancy of Site.
- B. Attendance Required: CONTRACTOR's Health and Safety Officer and Superintendent and major Subcontractors.
- C. Agenda:
 - 1. Use of Site by TRUST and CONTRACTOR.
 - 2. TRUST's requirements.
 - 3. Construction facilities and temporary controls provided by TRUST.
 - 4. Temporary utilities provided by TRUST.
 - 5. Survey and layout.
 - 6. Security and housekeeping procedures.
 - 7. Procedures and processing of field decisions, submittals, substitutions, progress payments, Field Orders, Requests for Quotation, Work Change Directives, Change Orders, and Contract closeout procedures.
 - 8. Schedules.
 - 9. Procedures for testing.
 - 10. Procedures for maintaining Record Documents.
 - 11. Requirements for startup of equipment.
 - 12. Inspection and acceptance of equipment put into service during construction period.
 - 13. Health and safety.

- D. ENGINEER will record minutes and distribute copies to participants and those affected by decisions made.

1.9 PROGRESS MEETINGS

- A. ENGINEER will schedule and administer progress meetings throughout the progress of Works at maximum bimonthly intervals or more frequently as required.
- B. ENGINEER will make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.
- C. Attendance Required: CONTRACTOR's Health and Safety Officer and Superintendent and when requested by ENGINEER major Subcontractors and Suppliers as appropriate to agenda topics for each meeting.
- D. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems which impede planned progress.
 - 5. Review submittals schedule and status of submittals.
 - 6. Review off-Site material fabrication/processing and delivery schedules.
 - 7. Review health and safety concerns and issues including air monitoring results.
 - 8. Maintenance of progress schedule.
 - 9. Corrective measures to regain projected schedules.
 - 10. Planned progress during succeeding work period.
 - 11. Coordination of projected progress.
 - 12. Maintenance of quality and work standards.
 - 13. Effect of proposed changes on progress schedule and coordination.
 - 14. Other business relating to Works.
- E. ENGINEER will record minutes and distribute copies to participants and those affected by decisions made. Identify errors in the minutes, if any, to ENGINEER in writing within 3 days of distribution of minutes.

1.10 PRE-INSTALLATION MEETING

- A. When required in an individual Section, convene a pre-installation meeting at Site prior to commencing work of such Section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific Section.
- C. Notify ENGINEER, in writing, 14 days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of installation, preparation, and installation procedures.
 - 2. Review coordination with related work.
- E. ENGINEER will record minutes and distribute copies to participants and those affected by decisions made.

1.11 EXAMINATION

- A. Prior to commencement of work at Site, inspect Site with ENGINEER to review and establish the condition of surface features including existing roads, parking areas, buildings, wells, trees and other plants, grassed areas, fencing, service poles, wires, paving, and survey bench marks or monuments on or adjacent to Site which may be affected by Works. This inventory shall be mutually agreed between ENGINEER and CONTRACTOR and shall not thereafter be subject to dispute. Such inventory as may be amended, from time to time, will be used by ENGINEER to check compliance by CONTRACTOR with the requirements of Contract Documents.
- B. Provide ongoing review, inspection, and attendance during performance of Works to properly document conditions. Promptly inform ENGINEER of any existing condition at Site affected by Works which may require restoration, repair, or replacement. Do not cover up any of Works without prior approval from ENGINEER.
- C. Maintain and protect existing Site structures and facilities from damage which may be affected by Works while work is in progress. Repair or replace damage resulting from Works to ENGINEER's approval.
- D. Verify that existing Site conditions and substrate surfaces are acceptable for subsequent work. Beginning new work means acceptance by CONTRACTOR of existing conditions.
- E. Verify that existing substrate is capable of structural attachment of new work being applied or attached or that existing or previously constructed surfaces are ready to receive subsequent work.
- F. Examine and verify specific conditions described in individual Sections.
- G. Verify that utility services are available, of the correct characteristics, and in the correct location.

1.12 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.

- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

1.13 RESTORATION

- A. As a minimum, restoration shall mean replacement, repairs, or reconstruction to a condition at least as good as or better than the condition prior to commencement of Works.
- B. Except where specifically required otherwise by other Sections, restore areas of Works and areas affected by the performance of Works to conditions that existed prior to commencement of Works and to match condition of similar adjacent, undisturbed areas.
- C. Ensure that restored areas match existing grade and surface drainage characteristics, except as otherwise specified, and ensure a smooth transition from restored surfaces to existing surfaces.
- D. Do not alter original conditions without prior written approval from ENGINEER.
- E. Without limiting the generality of the foregoing or other requirements of Contract Documents, *preserve and protect existing features encountered at Site during the performance of Works.*
- F. Utilize construction methods and procedures during the performance of Works which keeps disturbance and damage of whatever nature to existing conditions to the practical minimum. Where work necessitates root or branch cutting, do not proceed without ENGINEER's prior approval.
- G. Ensure that quality, grades, elevations, and extent of bedding, cover, and other backfill materials including subgrades, finish grades, thickness of pavements for roadways, and parking areas are properly documented during their removal to ensure reconstruction to at least their original and functional condition.
- H. Restoration Material: New, except as otherwise specified, not damaged or defective, and of the best quality for the purpose intended. Furnish evidence as to type, source, and quality of materials or products furnished when requested by ENGINEER or specified in other Sections.
- I. Should any dispute arise as to the quality or fitness of materials, whether obtained on Site or off Site, whether previously inspected by ENGINEER prior to use or not, the decision to use any material or product in the finished Works will rest solely with ENGINEER.
- J. Remove from Site clean material not approved for reuse.
- K. Handle and store products and materials in a manner to prevent damage, adulteration, deterioration, and soiling and in accordance with manufacturer's instructions when applicable.
- L. Prior to commencement of restoration work, inform ENGINEER of proposed material, methods, and procedures to repair, replace, or reconstruct disturbed, damaged, or suspected damage to Works.

- M. Perform cutting, fitting, remedial, and coordination work to make the several parts of Works fit together.
- N. Except as specified otherwise, dismantle and salvage materials for reuse where practicable. Exercise due care when removing material for salvage. Repair or replace materials damaged through improper handling or through loss after removal.
- O. Store and protect removed material approved for reuse in approved locations.
- P. Unless otherwise specified, restore pavement by:
 - 1. Removing and replacing the entire portions between joints or scores and not merely refinishing or patching localized areas.
 - 2. Saw cutting surfaces, curbs and gutters, and similar structures or surfaces.
 - 3. Protecting adjacent joints and load transfer devices and underlying granular materials.

END OF SECTION

SECTION 01019

CONTRACT CONSIDERATIONS

1.1 SECTION INCLUDES

- A. Measurement and payment.
- B. Change procedures.

1.2 MEASUREMENT AND PAYMENT

- A. Payment for Works will be made in lump sums and unit prices in accordance with Article 7 of Agreement.
- B. Measurement and payment requirements are delineated in the individual Sections and complement the criteria of this Article.
- C. CONTRACTOR's surveyor will take all measurements and compute quantities accordingly. ENGINEER will verify measurements of quantities as deemed necessary. Notify ENGINEER sufficiently in advance of operations to permit required measurements for payment. Assist by providing necessary equipment, workers, and survey personnel as required. Provide reasonable and necessary opportunities and facilities in making measurements.
- D. Measurement for Unit Price Work: As specified in individual Sections. Quantities indicated in Schedule of Prices are for bidding and contract purposes only and are approximate. Quantities of material furnished and/or work performed as verified by ENGINEER determine payment.
- E. Measurement for Lump Sum Work: ENGINEER will measure or quantify the amount of work eligible for progress payment purposes. Items will be measured in units such as time, weight, volume, area, or linear means, or combination as appropriate. Such measurements will serve as a basis for estimating percentage payments for partially completed work.
- F. Measurement Devices:
 - 1. Weigh Scales: Inspected, tested, and currently certified by the applicable state Weights and Measures department within the preceding 12 months.
 - 2. Platform Scales: Of sufficient size and capacity to accommodate the vehicle to be weighed.
 - 3. Metering Devices: Inspected, tested, and currently certified by the applicable state department.
- G. Payment for Each Item Includes: Full compensation for furnishing labor, supervision, material, tools, equipment, plant, transportation, services, and incidentals for performance and completion of Works in complete accordance with Contract Documents; erection, application, installation, completion, or construction of an item of Works; overhead and profit; all taxes; and all other miscellaneous items for which separate payment is not provided under other Items of Schedule of Prices. All work not specifically set forth as a separate pay Item in Schedule of Prices shall be considered as a subsidiary obligation of CONTRACTOR and all costs in connection therewith

shall be included in the amounts and prices stipulated in Schedule of Prices. CONTRACTOR shall properly and fairly distribute indirect costs to each pay Item. Final payment for work governed by unit prices will be made on the basis of the actual measurements and quantities approved by ENGINEER multiplied by the unit price stipulated in Schedule of Prices. Final payment for work governed by lump sum prices will be made on the basis of the applicable lump sum prices stipulated in Schedule of Prices.

H. Defect Assessment: Replace Works or portions of Works not conforming to specified requirements. If TRUST deems it expedient to accept the defective work, ENGINEER will direct one of the following remedies:

1. The defective work may remain, but the price will be adjusted to a new price at the discretion of ENGINEER.
2. The defective work will be partially repaired to the instructions of ENGINEER and the price will be adjusted to a new price at the discretion of ENGINEER.

I. Non-payment for Rejected Products: Payment will not be made for any of the following:

1. Products wasted or disposed of in a manner that is not acceptable.
2. Products determined as unacceptable before or after placement.
3. Products not completely unloaded from the transporting vehicle.
4. Products placed beyond the lines and levels of the required Works.
5. Products remaining on hand after completion of Works.
6. Loading, hauling, and disposing of rejected products.

1.3 CHANGE PROCEDURES

A. Changes in Works or the requirement for extra work will be made by ENGINEER in accordance with Gc.33 and Gc.34 of General Conditions and with the change procedures as specified herein.

B. Field Order: ENGINEER will advise of minor changes in Works and issue supplemental instructions not involving an adjustment to Contract Price or Contract Schedule as authorized by Contract Documents by issuing a Field Order. Promptly execute such minor changes and supplemental instructions.

C. Request for Quotation: ENGINEER may issue a Request for Quotation, which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications and schedule for executing the change in Works. CONTRACTOR shall prepare and submit a quotation by the due date stipulated in Request for Quotation with sufficient data to allow evaluation by ENGINEER. When requested by ENGINEER, furnish additional data to support computations including:

1. Quantities of products, labor, and equipment.
2. Taxes, insurance, and Bonds.

3. Overhead and profit.
 4. Justification for any change in Contract Schedule.
 5. Credit for deletions from Contract, similarly documented.
- D. Work Change Directive: ENGINEER may issue a directive on behalf of TRUST instructing CONTRACTOR to proceed with a change in Works, for subsequent inclusion in a Change Order. Document will describe change in Works, and designate method of determining any change in Contract Price or Contract Schedule. Promptly execute the change in Works.
- E. Change Order: Based on the requirements of Request for Quotation or Work Change Directive and prepared as follows:
1. A lump sum price Change Order will be executed on CONTRACTOR's fixed lump sum price quotation as approved by ENGINEER.
 2. A unit price Change Order will be executed on a fixed unit price basis for pre-determined unit prices and estimated quantities. For unit costs or quantities of units of work which are not pre-determined, execute Works under a Work Change Directive.
 3. A time and material Change Order will be executed on time and material rates approved by ENGINEER on a case-by-case basis. Submit an itemized account and supporting data after completion of change, within time limits indicated in Contract Documents. ENGINEER will determine the change allowable in Contract Price and Contract Schedule as provided in Contract Documents. Maintain detailed records of work done on a time and material basis in accordance with Contract Documents. Provide full information required to substantiate costs for changes in Works.
 4. A force account Change Order will be executed on Force Account Basis in accordance with Gc.35 of General Conditions.
- F. ENGINEER will prepare and issue Field Orders, Work Change Directives, and Change Orders, as required, for signatures of parties.
- G. When requested by ENGINEER, support each claim for work done on time and material rates with additional information including:
1. Origin and date of claim.
 2. Dates and times work was performed, and by whom.
 3. Time records and wage rates paid.
 4. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
- H. Promptly revise progress schedules to reflect any approved change in Contract Schedule, revise sub-schedules to adjust times for other items of work affected by the change, and promptly resubmit.

- I. Promptly enter changes in Record Documents.

END OF SECTION

SECTION 01111
HEALTH AND SAFETY

1.1 SECTION INCLUDES

- A. General requirements.
- B. Basis of program.
- C. Site characterization.
- D. Submittals.
- E. Health and safety officer.
- F. Personnel health, safety, and hygiene.
- G. Air monitoring.
- H. Contingency and emergency response plans.
- I. Site health and safety.
- J. Measurement and payment.

1.2 GENERAL REQUIREMENTS

- A. Develop a written Site-specific Health and Safety Plan prior to commencing any on-Site work and continue to implement, maintain, and enforce the plan until final demobilization from Site. The development, implementation, and maintenance of Site-specific Health and Safety Plan is CONTRACTOR's sole responsibility. CONTRACTOR's Site-specific Health and Safety Plan, as a minimum, shall address the specifications contained herein.
- B. The health and safety guidelines contained herein are intended to provide for a safe and minimal risk working environment for on-Site personnel and to minimize the impact of activities involving contact with any hazardous materials or hazardous wastes on the general public and the surrounding environment.
- C. Should CONTRACTOR seek relief from or substitution for any portion or provision of the minimum health and safety guidelines specified herein or the reviewed Site-specific Health and Safety Plan, such relief or substitution shall be requested of ENGINEER in writing, and if accepted by ENGINEER, will be authorized in writing.
- D. Responsibility: Be responsible for the safety of persons and property on Site and for the protection of persons off Site and the environment to the extent that they may be affected by the conduct of Works. Comply with and enforce compliance by CONTRACTOR employees and the employees of CONTRACTOR's Representatives with safety requirements of Contract Documents, Laws and Regulations, and ordinances, and with CONTRACTOR's Site-specific Health and Safety Plan. CONTRACTOR acknowledges that safety and environment protection

obligations are of paramount importance regarding all of the work to be performed under Contract Documents.

E. Hazard Communication Requirements:

1. Comply with the requirements of OSHA's "Hazard Communication" rule, 29 CFR 1910.1200. CONTRACTOR shall be responsible for obtaining information of any hazardous chemical or harmful physical agent to which CONTRACTOR, personnel of CONTRACTOR's Representatives, personnel and visitors have potential exposure while on Site.
2. CONTRACTOR shall provide ENGINEER with MSDS (Material Safety Data Sheet) documentation on any "hazardous" chemicals that CONTRACTOR plans to bring onto Site. In addition, CONTRACTOR shall be responsible for meeting container warning label requirements of OSHA rule.

F. Work Stoppage: CONTRACTOR shall give primary consideration to the safety and health of the public and on-Site personnel and the protection of the environment for all project work. Health and Safety Officer shall be responsible for decisions regarding when work will be stopped or started for health or safety considerations and shall have the authority to stop or start the work for health or safety considerations. CONTRACTOR shall assign the responsibility and obligation to Health and Safety Officer to stop or start the work when, in Health and Safety Officer's discretion, it is necessary or advisable for reasons of health or safety. ENGINEER shall have the right to stop work for health and safety considerations.

G. Unforeseen Hazards: Should any unforeseen or Site-peculiar safety-related factor, hazard, or condition become evident during the performance of Works at Site, bring such to the attention of ENGINEER verbally and in writing as quickly as possible, for resolution. In the interim, take prudent action to establish and maintain safe working conditions and to safeguard CONTRACTOR employees and employees of CONTRACTOR's Representatives, the public, TRUST, ENGINEER, and the environment.

H. Work Zone Restrictions: Do not work in Exclusion Zone or in Contaminant Reduction Zone (including any areas expected to become Exclusion Zone or Contaminant Reduction Zone), including work relating to the designation or establishment of Exclusion Zone or Contaminant Reduction Zone, until CONTRACTOR's Site-specific Health and Safety Plan is reviewed by ENGINEER. Other on-Site work may be conducted after the submittal of Site-specific Health and Safety Plan to, and prior to, its review by ENGINEER, but perform any such work only with the prior approval of ENGINEER. Implement the proposed Site-specific Health and Safety Plan, as submitted to ENGINEER, during the conduct of any work performed prior to ENGINEER's review of Site-specific Health and Safety Plan.

1.3 BASIS OF PROGRAM

- A. Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29, Code of Federal Regulations, Parts 1910 and 1926 (29 CFR 1910 and 1926) provide the basis for the health and safety program. The program also reflects the position of USEPA and NIOSH regarding procedures recommended or required to ensure safe operations at sites containing hazardous or toxic materials.

1.4 SITE CHARACTERIZATION

- A. Work at Site will involve contact with soils and oil sludges containing petroleum hydrocarbons, beryllium, lead, arsenic, polychlorinated biphenyls (PCBs) and volatile organic compounds (VOCs). These contaminants are listed in Appendix A.
- B. Work at the Site may involve the proximity of workers and equipment to a 345 kV high voltage transmission line.

1.5 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.

- B. CONTRACTOR's Site-Specific Health and Safety Plan:

- 1. Within 15 days after the date of Notice to Proceed and prior to mobilization to Site, submit a Site-specific Health and Safety Plan. As a minimum, address aspects of worker protection and measures designed to prevent migration of hazardous or contaminated material to the environment, including but not limited to the provisions and guidelines contained herein, and the following specific topics:
 - 1. Worker medical surveillance.
 - 2. Worker training.
 - 3. A detailed description of the planned movement of labor, equipment, and materials from and between work areas as work progresses, including measures to be employed to prevent recontamination of previously cleaned areas and contamination of areas that do not now contain hazardous materials.
 - 4. A detailed description of the personnel decontamination facilities to be employed including the planned phasing of decontamination facilities between work areas as work progresses and the methods to be used to collect, store, treat, and ultimately dispose of personnel decontamination waters and wastes.
 - 5. A detailed description of the washdown area for decontamination of vehicles and equipment and the methods to be used to collect, store, treat, and ultimately dispose of washdown decontamination waters and sediments.
 - 6. Confined space entry program and procedures if CONTRACTOR expects confined space work to be performed.
 - 7. Drum handling program in accordance with OSHA 29 CFR 1910.120(j).
 - 8. Personal protective equipment types to be used.
 - 9. Personal hygiene and personnel decontamination procedures.
 - 10. Respirator protection program and procedures.
 - 11. Personnel air monitoring.

12. Emergency and first-aid equipment and supply.
 13. Dust and particulate emission control.
 14. Employee arsenic and lead OSHA exposure controls in accordance with 29 CFR 1910.1018 and 1926.62.
 15. Monitoring and mitigation of worker heat and cold stress.
 16. On-Site and off-Site Contingency and Emergency Response Plans.
 17. A detailed description of measures to be taken when working near or under the high voltage power transmission line demonstrating compliance with 29 CFR 1910.333.
2. ENGINEER will review CONTRACTOR's Site-specific Health and Safety Plan and provide comments to CONTRACTOR within 14 days after receipt of the plan. Revise the plan as appropriate and resubmit the plan to ENGINEER within 7 days after receipt of comments from ENGINEER.
- C. Proof of OSHA Training: Within 7 days after the date of Notice to Proceed and prior to mobilization to Site, submit a list of all personnel that will be employed at Site. For each of the listed personnel, provide proof of training as required under OSHA 29 CFR 1910.120. Submit proof of training for any additional personnel, at least 7 days prior to the individual's arrival on Site.
- D. Medical Surveillance:
1. Within 7 days after the date of Notice to Proceed and prior to mobilization to Site, submit a report for medical examination conducted within the last 12 months as part of compliance with OSHA medical surveillance requirements for each of CONTRACTOR's personnel that will be employed at Site. As a minimum, submit the following information for each CONTRACTOR personnel:
 1. Name and Social Security Number and date of exam.
 2. Physician's statement that the worker is approved to wear and use the types of respiratory protection proposed for the project and is able to work safely in hazardous environments capable of producing heat stress in the worker.
 2. Submit reports on medical examination for any additional personnel at least 7 days prior to the individual's arrival on Site.
 3. Submit the name of the physician and evidence of examination of on-Site personnel prior to assigning personnel on-Site work activities in Exclusion Zone or Contaminant Reduction Zone.

1.6 HEALTH AND SAFETY OFFICER

- A. Employ and assign to Works a competent and authorized representative herein referred to as Health and Safety Officer. Health and Safety Officer shall be on Site during the execution of

work and report directly to and be under the direction of Certified Industrial Hygienist furnished by CONTRACTOR.

B. Certified Industrial Hygienist Responsibilities:

1. Oversee operations as necessary to ensure Works is performed in accordance with Site-specific Health and Safety Plan.
2. Oversee and be present during Health and Safety Training Sessions and, as a minimum, complete qualitative respirator fit testing.
3. Oversee Health and Safety Officer's activities on a part-time basis.
4. Be available on an as-needed basis for emergency situations.

C. Health and Safety Officer Experience and Responsibilities:

1. Have a minimum of 2 years Site-related working experience specific to the activities associated with PCB and VOC impacted materials management and Site remediation services.
2. Have a basic working knowledge of state and federal occupational safety and health regulations.
3. Have formal education and/or training in occupational safety and health.
4. Be responsible for completing Health and Safety Training Sessions and ensuring that personnel not successfully completing the required training are not permitted to enter Site to perform work in Exclusion Zone or Contaminant Reduction Zone.
5. Be responsible for implementing and daily enforcing and monitoring Site-specific Health and Safety Plan.
6. Be responsible for ensuring reusable personal protective equipment is decontaminated before being reissued.
7. Be responsible for performing air monitoring.
8. Ensure that on-Site personnel have obtained the required medical examinations (prior to arrival at Site and at the termination of their assignment) and have met OSHA training requirements.
9. Be responsible for the pre-construction indoctrination of on-Site CONTRACTOR personnel with regard to Site-specific Health and Safety Plan and other safety requirements to be observed during performance of Works, including:
 1. Potential hazards.
 2. Personal hygiene principles.
 3. Use of personal protective equipment and respiratory protection, including fit testing.

4. Emergency procedures for dealing with fire and medical situations.
10. Be responsible for incorporating the provisions of both on-Site and off-Site Contingency and Emergency Response Plans in Site-specific Health and Safety Plan and maintaining a state of readiness to enact the provisions.
11. Be responsible for alerting appropriate on-Site and/or off-Site emergency services and ENGINEER before starting any particularly hazardous work.
12. Assist ENGINEER in contacting and advising local authorities of Works to be performed.
13. Have the authority and obligation to stop all, or any part of Works if, in his sole discretion, stoppage of Works is necessary or advisable for considerations of health or safety.

1.7 PERSONNEL HEALTH, SAFETY, AND HYGIENE

A. Medical Surveillance:

1. Conduct medical surveillance of personnel as required by 29 CFR 1910.120 and 29 CFR 1910.134.
2. Retain the services of a licensed occupational physician or physician's group to provide the medical examinations and surveillance required. Furnish pertinent Site characterization data, a copy of 29 CFR 1910.120, and a description of the intended personal protective equipment to the occupational physician prior to completing medical surveillance. Maintain CONTRACTOR personnel medical approvals at CONTRACTOR's Site office for the duration of Works performed at Site.
3. Medical surveillance protocol shall be the occupational physician's responsibility but shall meet the requirements of 29 CFR 1910.120 and 29 CFR 1910.134 for all personnel. This exam may include:
 1. Medical/occupation questionnaire with work history.
 2. Full physical examination.
 3. Screening audiometric test with otoscopic exam for occlusion or perforation.
 4. Visual acuity measurement, including color perception.
 5. Pulmonary function test (Spirometry - FVC and FEV-1.0 second).
 6. Resting EKG.
 7. Chest x-ray.
 8. Blood chemistry profile as deemed appropriate by the attending physician for hazardous waste work.

9. Complete blood count with differential and platelet evaluation, including WBC, RBC, HGB, hematocrit.
 10. Urinalysis with microscopic examination.
 11. Other Site-specific medical monitoring as required by Site-specific conditions.
4. Furnish on-Site personnel requiring full medical surveillance with medical surveillance within the 12-month period prior to entering Site, and at any time there is suspected to be excessive exposure to toxic chemicals or physical agents. Remove on-Site personnel, who become due for an annual physical examination, from the work force immediately until medical requirements are met in accordance with 29 CFR 1910.120 and 29 CFR 1910.134.
 5. Maintain medical surveillance records in accordance with 29 CFR 1910.120 and 29 CFR 1910.134.

B. Training:

1. Furnish personnel assigned to or entering Site with complete Site-specific training or refresher sessions. Site-specific training and refresher sessions shall ensure that personnel are capable of and familiar with the use of safety, health, respiratory, and protective equipment and with the safety and security procedures required for Site. The training session shall be completed by CONTRACTOR's Health and Safety Officer.
2. As a minimum, include the following items in the training program:
 1. Names and personnel responsible for Site health and safety.
 2. Site-specific potential hazards.
 3. Use of personal protective equipment (PPE), including proper donning and doffing procedures.
 4. Work practices by which the employee can minimize risks from Site-specific potential hazards.
 5. Confined space entry procedures (if confined space work is to be performed).
 6. Safe use of engineering controls and on-Site equipment.
 7. Discussion and completion of medical surveillance requirements and recognition of symptoms associated with exposure to hazards.
 8. Site control methods.
 9. On-Site and off-Site Contingency and Emergency Response Plans.
 10. Decontamination procedures.
 11. Site-specific standard operating procedures.
 12. Delineation between work zones.

13. Use of the buddy system.
 14. Scope of the intended work for Contract.
 15. Review on-Site communications and appropriate hand signals between personnel working in Exclusion Zone and/or Contaminant Reduction Zone.
 16. The content of OSHA standards, including the Appendices.
3. In accordance with 29 CFR 1910.120, furnish training to employees assigned to or entering Exclusion Zone or Contaminant Reduction Zone including a minimum of 40 hours instruction off Site and 3 days of actual field experience under direct supervision of a trained and experienced supervisor and an 8-hour annual refresher. Furnish documentation stating that on-Site personnel expected to enter potentially contaminated work areas have complied with this regulation. Include each individual's name on this confirmatory letter.
 4. Implement a hazard communication ("Right-to-Know") program in accordance with 29 CFR 1910.1200.

C. Levels of Protection:

1. Establish levels of protection for each work area based on planned activity, location of activity, and air monitoring results. Monitor potential exposures to hazardous materials with a photoionization device (oxygen level meter and explosimeter for confined space work).
2. Furnish minimum Level C personal protective equipment (PPE) in Exclusion Zone until initial air monitoring results are available. After the air monitoring results are available, increase or decrease the level of PPE, but to not less than Level C for waste handling activities. The anticipated levels of personal protection based on work activity are as follows:

Work Activity	Anticipated Level of Personal Protection
1. Sludge and Contaminated Soil Removal	Level C
2. Sludge Stabilization	Level C
3. Lagoon Dewatering	Modified Level C
4. Landfill Construction	Level D
5. Drum/Container Removal	Level C

D. Personal Protective Equipment:

1. Furnish on-Site CONTRACTOR personnel with appropriate PPE. Ensure that safety equipment and protective clothing is kept clean and well maintained. As a minimum,

supply each worker entering or expected to enter Exclusion Zone or Contaminant Reduction Zone with:

1. Disposable coveralls, liquid resistant, splash resistant, full coverage.
 2. Individually assigned half- or full-facepiece air purifying respirators (NIOSH approved) with appropriate dual organic vapor/high-efficiency particulate filters. Respirators shall be available for on-Site personnel at all times.
 3. Disposable outer gloves, chemical resistant (nitrile).
 4. Disposable inner gloves, thin nitrile or latex.
 5. Steel-toed, steel-shank, chemical-resistant safety boots.
 6. Disposable rubber, chemical-resistant overboots, butyl rubber or neoprene.
 7. Work clothing (full-length pants, long-sleeve shirt).
 8. Hardhats.
 9. Safety glasses with sideshields.
2. Based on the work activity and the anticipated level of personal protection as specified in Paragraph 1.7 C, furnish on-Site CONTRACTOR personnel with appropriate PPE. Ensure that safety equipment and protective clothing is kept clean and well maintained. As a minimum, supply each worker entering or expected to enter Exclusion Zone or Contaminant Reduction Zone with protection as specified in Paragraph 1.7 C. The following are the minimum PPE required for each level of protection, as applicable:
1. Level A:
 1. Individually assigned open circuit, positive pressure Self-contained Breathing Apparatus or Type C hoseline, with pressure/demand regulator with escape unit.
 2. Totally-encapsulating chemical-protective suit.
 3. Coveralls.
 4. Long underwear - optional.
 5. Gloves - outer, chemical resistant.
 6. Gloves - inner, thin nitrile or latex.
 7. Boots, chemical resistant, steel toe and shank.
 8. Hard hat (under suit).

2. Level B:

1. Two-piece, hooded, chemical-resistant suit (saranex).
2. Individually assigned open circuit, positive pressure Self-contained Breathing Apparatus or Type C hoseline, with pressure/demand regulator with escape unit.
3. Inner gloves, thin nitrile or latex.
4. Chemically protective outer gloves.
5. Boots, steel toe and shank.
6. Disposable, chemical-resistant overboots, butyl rubber or neoprene.
7. Hard hat.
8. Working uniform complete with full-length pants, long-sleeve shirt, socks, and underwear.

3. Level C:

1. Individually assigned half- or full-facepiece air-purifying respirators (NIOSH-approved), with appropriate cartridges for organic vapors and particulates.
2. Chemical-resistant disposable coveralls (tyvek).
3. Latex and/or cotton inner gloves.
4. Nitrile outer gloves.
5. Work boots with steel toe and shank.
6. Chemical-resistant overboots or booties, butyl rubber or neoprene.
7. Hard hat.
8. Safety glasses with side shields and/or chemical-resistant goggles.

4. Modified Level C:

1. Individually assigned half- or full-facepiece air-purifying respirators (NIOSH approved), with appropriate cartridges for organic vapors and particulates. Respirators shall be available at all times and donned when required as indicated by air monitoring.
2. Chemical-resistant disposable coveralls (tyvek).
3. Latex and/or cotton inner gloves.

4. Nitrile outer gloves.
 5. Work boots with steel toe and shank.
 6. Chemical-resistant overboots or booties, butyl rubber or neoprene.
 7. Hard hat.
 8. Safety glasses with side shields and/or chemical-resistant goggles.
5. Level D:
1. Hard hat.
 2. Safety glasses with side shields or goggles.
 3. Long pants and long-sleeve shirt.
 4. Safety boots.
 5. Any personal protective equipment necessary for specialized tasks (e.g., welding goggles).
3. Develop protective equipment usage procedures and ensure that procedures are strictly followed by on-Site personnel; include the following procedures as a minimum:
1. Do not permit prescription eyeglasses to be worn that are not safety glasses. Do not permit contact lenses on Site within Exclusion Zone or Contaminant Reduction Zone.
 2. Change respirator cartridges/filters daily during periods of respirator usage or upon breakthrough, whichever occurs first.
 3. Do not permit footwear to be worn that is not steel-toed safety shoes or boots. Cover footwear by rubber overshoes when entering or working in Exclusion Zone.
 4. Dispose of or decontaminate PPE worn on Site at the end of the work day.
 5. Decontaminate reusable PPE before reissuing.
 6. Do not permit on-Site personnel who have not passed a respirator fit test to enter potentially contaminated work areas and/or Contaminant Reduction Zone. Do not permit personnel to have facial hair that interferes with a proper fit of the respirator.
 7. As a minimum, require on-Site personnel within potentially contaminated work areas to wear approved PPE including, but not necessarily limited to, hardhats and safety boots.

E. Respiratory Protection:

1. Provide on-Site personnel with extensive training in the usage and limitations of, and qualitative fit testing for, half- and full-facepiece respirators in accordance with 29 CFR 1910.134; include both air-purifying and supplied-air type respirators.

2. Develop, implement, and maintain the respirator program. Incorporate or attach a copy of the respirator program to CONTRACTOR's Site-specific Health and Safety Plan.
3. Monitor, evaluate, and provide respiratory protection for on-Site personnel.
4. Levels of respiratory protection as listed in Paragraph 1.7 C have been chosen to be consistent with Site-specific potential airborne hazards associated with the major contaminants identified at Site. The selection of appropriate protection is based upon the potential presence of compounds with the lowest recommended threshold limit value.
5. In the absence of additional air monitoring information or substance identification, the following minimum levels of respiratory protection will be required:

<i>Sustained Total Organic Vapor Concentration Above Background (ppm)</i>	<i>Level of Respiratory Protection Required</i>
1 ppm - 49	Half- or full-facepiece respirator available
49 - 500	Full- or half-facepiece air-purifying respirator, Level C
>500	Shut down activities, evaluate the need for Level B or higher respiratory protection

6. Immediately notify ENGINEER when level of respiratory protection required increases from Level D to Level C or from Level C to Level B.
7. Be responsible for appropriate respiratory protection during work activities. As a minimum, ensure that persons entering Exclusion Zone or Contaminant Reduction Zone are supplied with and use appropriate respiratory protection.
8. Be responsible for assessing the ability for on-Site personnel to wear respiratory protection. Cardiopulmonary system examination and pulmonary function testing are minimum requirements as specified in Paragraph 1.7 A.
9. Do not permit on-Site personnel unable to pass a respirator fit test to enter Exclusion Zone or Contaminant Reduction Zone. Furnish proof of such fit testing to ENGINEER prior to commencing work.

F. Heat Stress/Cold Stress:

1. Implement a heat stress and/or cold stress monitoring program as applicable; include as a minimum the following specific components:
 1. Training of personnel to recognize and mitigate heat/cold stress situations and symptoms.
 2. Target conditions which will initiate monitoring of personnel.

3. Monitoring methods.
 4. The means and methods by which CONTRACTOR will mitigate such conditions.
2. Base the heat stress/cold stress program on recommendations by ACGIH, NIOSH, and other recognized authorities.

G. Personnel Hygiene and Personnel Decontamination Procedures:

1. Ensure that on-Site personnel observe and adhere to the personal hygiene-related provisions of this Section.
2. Issue a written notice of violation to on-Site personnel found to be disregarding the personal hygiene-related provisions of Site-specific Health and Safety Plan or Project Specifications (including but not limited to the requirements concerning PPE specified in Paragraph 1.7 D respiratory protection specified in Paragraph 1.7 E and personnel hygiene and personnel decontamination procedures specified in Paragraph 1.7 G.) The notice may be issued by ENGINEER, Health and Safety Officer, or any supervisory personnel of CONTRACTOR. Give a copy of the notice to the offending worker, to his immediate supervisor, to CONTRACTOR's Superintendent, and to ENGINEER. Upon issuance of a second written notice of such violation, terminate the worker from employment at Site.
3. Failure of CONTRACTOR's supervisory personnel to implement this warning/termination provision shall be deemed a material breach of Contract.
4. Provide, as a minimum, the following:
 1. Suitable containers for storage and disposal of used disposable PPE.
 2. Potable water and a suitable sanitation facility.
5. Enforce the following provisions:
 1. Require on-Site personnel to wear appropriate PPE at all times when entering or working in Exclusion Zone or Contaminant Reduction Zone.
 2. Do not permit used disposable PPE to be reused, and when removed, place PPE inside appropriate containers provided for that purpose.
 3. Prohibit smoking, chewing nicotine products, eating, and drinking, except in a designated lunch or break area.
 4. Require removal of soiled disposable outerwear prior to entering the lunch area, and prior to cleansing hands.
 5. Require on-Site personnel to thoroughly cleanse their hands and other exposed areas before entering the smoking or lunch areas.
 6. Require personnel working in the potentially contaminated work areas and/or Contaminant Reduction Zone to shower and change to fresh clothing after each working period or shift, prior to leaving Site.

7. Launder used work clothing daily (in a facility provided by CONTRACTOR, at a location specified by ENGINEER).
8. Store wastewater generated from washing and showering in designated wastewater storage tank(s) in accordance with Section 01500.
6. Place discarded disposable outerwear, gloves, and outer footwear in sealable containers. Prior to placement, segregate discarded articles of clothing and secure in plastic bags. Place articles which are soiled, stained, or have been in contact with contaminated materials in separate CONTRACTOR-supplied sealable containers. Place remaining clean articles of clothing in CONTRACTOR-supplied general refuse containers.

H. Emergency and First-Aid Equipment:

1. Locate and maintain emergency and first-aid equipment in appropriate location on Site. Store equipment on portable pallets in order that it may be easily transported within the active work location. Include the following equipment as a minimum:
 1. First-aid kit to accommodate the numbers of on-Site personnel.
 2. Portable emergency eye wash.
 3. Two 20-pound ABC type dry chemical fire extinguishers.
 4. Two self-contained breathing apparatus units (if confined space entry is to occur).
 5. Blankets and towels.
 6. Stretcher.
 7. One hand-held emergency siren.
 8. Two complete sets of Level B equipment.
2. As a minimum, provide one certified first-aid technician on Site at all times that on-Site work activities are in progress. This technician may perform other duties but shall be immediately available to render first aid when needed.

I. Site Communications:

1. Post emergency numbers near Site telephones in accordance with on-Site and off-Site Contingency and Emergency Response Plans.
2. Ensure that personnel work under the use of a "buddy" system and develop a hand signal system appropriate for Site activities.
3. Provide an employee alarm system to notify employees of on-Site emergency situations or to stop work activities if necessary.
4. Furnish selected personnel with two-way radios in accordance with Section 01500.

- J. Safety Meetings: Conduct mandatory daily safety meetings for on-Site personnel, and additionally as required by special or work-related conditions; include refresher training for existing equipment and protocols, review ongoing safety issues and protocols, and examine new Site conditions as they are encountered. Hold additional safety meetings on an as-needed basis.
- K. Custodian: Employ and furnish a Custodian who shall report directly to Health and Safety Officer and who shall be responsible for keeping safety equipment and facilities clean, properly equipped, and maintained. Custodian may perform other duties for CONTRACTOR but Custodian's first priority shall be maintenance of protective equipment and the personnel decontamination area.

1.8 AIR MONITORING

A. Air Monitoring Program:

1. During the progress of work activities, monitor air quality in and around Exclusion Zone. Conduct monitoring on a regular periodic basis, and additionally as required by special or work-related conditions. Report any departures from general background to ENGINEER who will, in conjunction with Health and Safety Officer, determine when operations should be shut down and restarted.
2. Provide the required instruments for air monitoring including, as a minimum, an organic vapor photoionizer or organic vapor analyzer and if confined space work is to occur, an oxygen level meter and an explosimeter. Additionally, personnel sampling pumps and dust monitors may be required if Site conditions warrant. Provide sufficient numbers of each instrument to monitor the active work location and to provide backup equipment in cases of equipment malfunction.
3. Operate air monitoring equipment with personnel trained in the use of the specific equipment provided and under the control of Health and Safety Officer. Monitoring equipment used within the potentially contaminated work areas with combustible gases shall be intrinsically safe.
4. Conduct air monitoring for organic vapors on a routine basis around active work locations. Perform monitoring as a minimum on an hourly basis and additionally as dictated by Site activities.
5. Furnish a wind speed and direction indicator capable of providing a permanent record, at an unobstructed location on Site located above the elevation of the work area with unobstructed view.

B. Air Monitoring Reporting:

1. Report air monitoring results daily to ENGINEER on specific forms. Include the following information as applicable:
 1. Site location/date.
 2. Work process/operation name.
 3. Temperature, wind speed, and wind direction.

4. Area sampling location diagram.
5. Field notes including the following:
 1. Description of operations and complaints/symptoms.
 2. Chemicals/materials/equipment in use.
 3. Engineering/administration controls in effect.
 4. Personal protective equipment in use.
 5. Sampling observations/comments.
2. In addition, record daily air monitoring activities in a hard cover log book; maintain log book on Site at all times.

1.9 CONTINGENCY AND EMERGENCY RESPONSE PLANS

- A. General: Prior to mobilization to Site prepare both on-Site and off-Site Contingency and Emergency Response Plans to ensure the safety of on-Site and off-Site personnel. Incorporate on-Site and off-Site Contingency and Emergency Response Plans into CONTRACTOR's Site-specific Health and Safety Plan.
- B. On-Site Contingency and Emergency Response Plan: Address the standard operating procedures to be implemented during emergency situations. Include and address the following emergency situations and responses as a minimum:
 1. In the event of injury to on-Site personnel or contact with hazardous materials requiring immediate medical attention, implement the following protocol:
 1. Notify Health and Safety Officer and ENGINEER.
 2. Phone the hospital previously identified to be closest to Site and describe injury.
 3. Decontaminate personnel and administer appropriate first aid.
 4. Transport personnel to the specified hospital along the most direct route which shall be predefined prior to commencing Site work.
 2. In the event that barrels or canisters are encountered during Works, immediately cease work and notify Health and Safety Officer and ENGINEER; determine appropriate modifications to Site-specific Health and Safety Plan in conjunction with ENGINEER and Health and Safety Officer.
 3. In the event that excessive gases or vapors are detected during Works, take the following actions:
 1. Evacuate workers to an area upwind from the affected area.

2. Identify the contaminant and monitor contaminant concentrations to determine the type of respiratory protection and/or engineering controls required before workers re-enter the area.
 4. In the event of a fire during Works, quickly use earthmoving equipment to backfill the area and smother the fire if possible and if the presence of noxious gases prohibits this, employ proper evacuation procedures.
 5. Maintain on-Site near the stabilization process equipment or on a dedicated vehicle foam generating equipment capable of supplying 35 cubic feet of fire suppressing foam in a 1 minute period, and at least 75 cubic feet without need of refill. Foam shall be low in toxicity, non-corrosive and biodegradable.
 6. In the highly unlikely event of a major leak of toxic gas, such as might occur if a compressed gas cylinder were encountered and ruptured during Works, evacuate on-Site personnel to a safe distance, and notify Police and Fire Department and local hospital if deemed necessary by ENGINEER or Health and Safety Officer. Police and Fire Department Officials will assume responsibility for coordinating with ENGINEER and Health and Safety Officer for the proper emergency response strategy upon arrival.
- C. Off-Site Contingency and Emergency Response Plan:
1. Prior to commencing work involving the handling of hazardous materials, develop off-Site Contingency and Emergency Response Plan. This plan is intended to provide immediate response to a serious Site occurrence such as explosion, fire, or migration of significant quantities of toxic or hazardous material from Site which could affect or endanger the public or adjacent public or private areas.
 2. ENGINEER will be responsible for coordination of meetings with local officials, issuing minutes of meeting, and distribution of off-Site Contingency and Emergency Response Plan.
 3. Attend a coordination meeting to be held with appropriate authorities including City, Fire, Hospital, State and City Police, State Department of Transportation, County Health Department, and Community Emergency Coordinator; meeting will identify off-Site Emergency Response Coordinator through whom all information and coordination will occur in the event of an incident. Develop plans and procedures, or adopt existing plans and procedures, for:
 1. Fire-fighting procedures.
 2. Transport of injured personnel to medical facilities.
 3. Priority transportation routes.
 4. Coordination and/or modification of highway operations.
 4. Develop techniques and recommended procedure for immediate first-aid emergency response with local medical facilities.

1.10 SITE HEALTH AND SAFETY

- A. **Work Areas:** Clearly lay out and identify work areas in the field and limit equipment, operations and personnel in the areas as defined below. Establish work areas as temporary or permanent, depending on the work activity and the sequence in which it is performed. These areas are:
1. **Exclusion Zone:** Includes areas where hazardous or potentially contaminated (soils, debris, and other materials) are being, or may be contacted, disturbed, or handled and areas where contaminated equipment or personnel travel. Establish temporary Exclusion Zones around remote work areas beyond the limits of Exclusion Zone located within Site fence; clearly delineate temporary Exclusion Zones with temporary fencing and warning signs.
 2. **Contaminant Reduction Zone:** Occurs at the interface of Exclusion Zone and Clean Zone and provides for the prevailing upwind transfer of construction materials from clean to Site-dedicated equipment, the decontamination of equipment and vehicles prior to entering Clean Zone from Exclusion Zone, the decontamination of personnel and clothing prior to entering Clean Zone from Exclusion Zone, and for the physical segregation of Clean and Exclusion Zones.
 3. **Clean Zone:** Defined as a clearly delineated predominantly upwind area outside Exclusion Zone(s) and Contaminant Reduction Zone(s), which functions include:
 1. An entry area for personnel, material, and equipment to Contaminant Reduction Zone.
 2. An exit area for decontaminated personnel, material, and equipment from Contaminant Reduction Zone.
 3. A storage area for clean safety and work equipment.
- B. **Temporary Fencing:**
1. Erect temporary fencing to delineate work areas in accordance with Site-specific Health and Safety Plan.
 2. **Temporary Fencing:** Standard snow fence or construction fence supported by posts; complete with warning signs.
 3. Coordinate the erection of temporary fencing with the work specified under other Sections. Prior to or during mobilization erect fencing to enclose Exclusion Zone.
 4. Reuse existing temporary fencing; decontaminate temporary fencing prior to reuse.
- C. **Contaminant Migration Control:**
1. Prevent contaminant tracking on and off Site. Decontaminate vehicles, equipment, and personnel leaving areas of potential contamination, as determined by Health and Safety Officer, prior to entry into Clean Zones. Locate decontamination facilities and sequence work activities to prevent contaminant tracking.
 2. Furnish to and ensure that personnel engaged in vehicle decontamination wear protective equipment including suitable disposable clothing, respiratory protection, and face shields.

D. Drum Handling Program:

1. Drums: Comply with DOT, OSHA, USEPA, and state regulations for the wastes that they contain. Label drums as to content and date filled.
2. Coordinate Site operations to minimize the amount of drum or container movement. Inspect drums prior to shipment and stage drums to facilitate inspection.
3. Keep appropriate salvage drums available for use in areas where spills or leaks may occur. Implement a spill containment program to contain and isolate any and all of the hazardous substances being transferred.

E. Confined Space Entry Program:

1. Responsibility: Health and Safety Officer shall be responsible to ensure that minimum precautions as specified herein have been taken to assure safe entry of confined spaces in accordance with 29 CFR 1910.146.
2. Procedure:
 1. Time Period Covered by Permits:
 1. Do not allow Site personnel to enter confined space without a written confined space work permit.
 2. Issue the confined space work permit with validity for a single shift only. On jobs requiring more than a single shift to bring to completion, issue a new permit at the start of each shift.
 2. Variances:
 1. Inability to Follow Procedure: Should any circumstances be found where these rules cannot be met, rules to insure adequate safety for entering these specific confined spaces shall be written out by Health and Safety Officer, for approval in accordance with Site-specific Health and Safety Plan. Detail any special conditions associated with this variance and attach to the confined space work permit.
 3. Availability of Permit: Maintain properly completed permits readily available at Site. Keep permit on file indefinitely after the completion of the shift for which they were issued.
 4. Preparation of Equipment For Safety:
 1. Power: De-energized, locked, and tagged.
 2. Remove hazardous contents from the confined space. Conduct tests for hazardous materials, flammable vapor and oxygen content on a continuous basis while anyone is in the confined space. If the tests do not meet the requirements of subparagraphs 1.10 E.5.1 and 1.10 E.5.2, require the workers to leave the confined space.

5. Testing of Atmospheres Within Confined Spaces:
 1. Oxygen Content: Above 19.5 percent and below 23.5 percent before entry will be allowed.
 2. Flammable Vapors: Require personnel to leave confined spaces if the concentration of explosive gases exceeds 10 percent of the lower explosive limit (LEL). If hot work is to be conducted in the space, then explosive gasses cannot exceed 0 percent (LEL).
6. Ingress and Egress: Maintain a safe means of ingress and egress, such as a portable ladder, in place at all times when personnel are occupying a confined space.
7. Protective Clothing: Modified Level C protection shall be worn as a minimum by personnel entering confined spaces where the confined space has been made vapor free, meaning the vapor concentration is below Threshold Limit Value (TLV) of the vapor being monitored, the total organic vapor readings are less than 5 ppm, LEL is zero and the oxygen content is between 19.5 and 23.5 percent, and continuous air monitoring with a photoionization detector, oxygen meter, and explosimeter is maintained. If all these conditions are not met, Level B protection shall be worn. Site-specific Health and Safety Plan shall include a full confined space entry program.
8. Life Lines: Provide each authorized entrant with a chest or full body harness, with a retrieval line attached at the center of the entrant's back near shoulder level or above the entrant's head. Wristlets may only be used if it can be demonstrated that the use of wristlets is the safest and most effective alternative. The other end of the retrieval line shall be attached to a mechanical device or fixed point outside the permit space such that rescue can begin immediately if required.
9. Illumination:
 1. Temporary Lighting in the Confined Space: Explosion-proof design with heavy-duty cords and fittings and insulations maintained in good condition.
 2. Portable Lighting: Operated at a maximum of 12 volts; kept at-the-ready outside of the confined space access opening to be used as illumination in the event of failure of the principle system; capable of providing illumination for a period of at least 1 hour.
10. Safety Monitors:
 1. A person designated as a safety monitor shall be trained in first aid and CPR and stationed at the access opening of any confined space while it is occupied. He/she shall have continuous visual or verbal contact with occupants. One of his/her major responsibilities shall be to summon additional help in emergency situations.
 2. In addition to the safety monitor, provide another person located within 100 feet of the confined space opening. This individual may do work other

than that related to the confined space entry but such work shall not prevent his/her responding to a call for aid.

11. **Equipment Immediately Available to the Safety Monitor:** Locate the following emergency items at the access opening of the confined space or not more than 15 feet from such opening:
 1. Respiratory equipment as specified for Level B protection.
 2. Life lines, as described in subparagraph 1.10 E.8.
 3. A battery powered portable light, as described in subparagraph 1.10 E.9.
 4. A portable type air-horn, capable of being heard 100 feet away over background noises.

END OF SECTION

SECTION 01300

SUBMITTALS

1.1 SECTION INCLUDES

- A. Submittal procedures.
- B. Construction progress schedules.
- C. Proposed products list.
- D. Shop Drawings.
- E. Product data.
- F. Samples.
- G. Manufacturer installation instructions.
- H. Manufacturer certificates.
- I. Construction photographs.
- J. Project organization chart.
- K. Submittals for progress meetings.
- L. Site layout.
- M. Record Documents.
- N. Operation and maintenance data.
- O. Warranties.
- P. Summary of major project submittals.
- Q. Schedule of Submittals.
- R. Measurement and payment.

1.2 SUBMITTAL PROCEDURES

- A. Unless directed otherwise, transmit submittals to ENGINEER at the address set forth in Special Conditions.
- B. Transmit each submittal with ENGINEER accepted form and the correct number of copies.

- C. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
- D. Before transmitting each submittal, determine and verify the following:
 - 1. Field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto.
 - 2. Materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of Works.
 - 3. Information relative to CONTRACTOR's sole responsibilities in respect of means, methods, techniques, sequences and procedures of construction, and safety precautions and programs incident thereto.
- E. Identify Contract, CONTRACTOR, Subcontractor, or Supplier; pertinent drawing and detail number and Section number, as appropriate.
- F. Review and coordinate each submittal with other submittals and with the requirements of Works and Contract Documents. Coordinate submission of related items.
- G. Apply CONTRACTOR's approval stamp prior to initial submission to ENGINEER, signed and dated, certifying that CONTRACTOR has satisfied CONTRACTOR's obligations under Contract Documents including but not limited to review and approval, verification of products required, field dimensions, adjacent construction work, and coordination of information with respect to CONTRACTOR's review and approval of that submittal. Unstamped or unsigned submittals will be returned by ENGINEER without action.
- H. Except as specified otherwise, for each submittal for review by ENGINEER allow 15 days excluding delivery time to and from CONTRACTOR. Schedule submittals to expedite Contract and in accordance with specified scheduling.
- I. At time of each submission, give ENGINEER specific written notice of such variations, if any, that the submittal may have from the requirements of Contract Documents, such notice to be in written communication separate from the submittal; and, in addition, cause a specific notation to be made on each submittal submitted for ENGINEER's review of each such revision.
- J. Identify product or system limitations which may be detrimental to successful performance of the completed Works.
- K. Provide space for ENGINEER review stamp and comments on submittals.
- L. ENGINEER will review submissions in accordance with the schedule established for each submittal. ENGINEER's review will be only to determine if the items covered by the submittals will, after installation or incorporation in Works, conform to the information given in Contract Documents and be compatible with the design concept of the completed Works as a functioning whole as indicated by Contract Documents. ENGINEER's review will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by Contract Documents), or to safety precautions or programs incident thereto. The review of a separate item as such will not indicate approval of the assembly in which the item functions. Make corrections to each submittal required by ENGINEER, return the required number of

corrected copies of each submittal, and submit as required new submittals required by such correction. Direct ENGINEER's specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals.

- M. Promptly revise and resubmit; identify changes made since previous submission and changes other than those requested by ENGINEER.
- N. Promptly distribute copies of reviewed submittals to Subcontractors, Suppliers, and other concerned parties as appropriate. Instruct parties to promptly report any inability to comply with provisions.
- O. Submittals not requested will not be recognized or processed. Submittals received directly from Subcontractors, Suppliers, vendors, or other CONTRACTOR Representatives will be returned by ENGINEER without action.
- P. Adjustments made on CONTRACTOR's drawings by ENGINEER are not intended to change Contract Price. If adjustments affect Contract Price, state such in writing, as specified elsewhere in Contract, to ENGINEER prior to proceeding with Works.
- Q. ENGINEER's review of CONTRACTOR's submittals shall not relieve CONTRACTOR from responsibility for any variation from the requirements of Contract Documents unless CONTRACTOR has in writing called ENGINEER's attention to each such variation at the time of submission as required in Paragraph 1.2 I; nor will any review by ENGINEER relieve CONTRACTOR from responsibility for complying with the requirements of Paragraph 1.2 D.
- R. Where a submittal is required by Contract Documents, any related Works performed prior to ENGINEER's review of the pertinent submittal will be at the sole expense and responsibility of CONTRACTOR.
- S. Requirements of this Article 1.2 shall apply to all required submittals.

1.3 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit initial detailed construction progress schedule with Bid. Submit revised detailed construction schedule within 14 days after the date of Notice to Proceed and prior to commencing work at Site.
- B. Revise and resubmit as required.
- C. If CONTRACTOR believes it necessary or advantageous to change sequence of activities shown on CONTRACTOR's construction progress schedule, submit proposed revisions to ENGINEER for approval. No change shall be made in the order in which work activities are being performed until ENGINEER's written approval for the revised schedule has been obtained. The schedule will be acceptable to ENGINEER as providing an orderly progression of Works to completion within any specified dates identified in Section 01010, but such acceptance will neither impose on ENGINEER responsibility for the sequencing, scheduling, or progress of Works nor interfere with or relieve CONTRACTOR from CONTRACTOR's full responsibility therefore.
- D. Submit a horizontal bar (Gantt) chart with separate line for each major section of Works or operation, identifying first work day of each week.

- E. Show complete sequence of construction by activity, identifying work of separate stages and other logically grouped activities in accordance with Contract Schedule issued by ENGINEER and identified in Section 01010. Show coordination of interrelated work activities and items. Indicate the early and late start, early and late finish, float dates, and duration.
- F. Indicate estimated percentage of completion for each item of Works at each submission.
- G. Indicate submittal dates required for Shop Drawings, product data, samples, and product delivery dates, including those furnished by TRUST.

1.4 PROPOSED PRODUCTS LIST

- A. Within 15 days after the date of Notice to Proceed and prior to products arrival on Site, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards or description, give manufacturer, trade name, model or catalog designation, and reference standards.
- C. For products requiring special handling procedures, submit Material Safety Data Sheet prior to product's arrival on Site.

1.5 SHOP DRAWINGS

- A. When specified in individual Sections, prepare detailed drawings of material and structures to be supplied by CONTRACTOR from typical details shown on "Approved for Construction" Drawings and/or from specified requirements.
- B. Indicate special utility and electrical characteristics, utility connection requirements, location of utility outlets for service for functional equipment and appliances.
- C. Indicate materials, methods of construction, attachment or anchorage, erection diagrams, connections, explanatory notes, and other information necessary for completion of Works.
- D. Where articles or equipment attach or connect to other articles or equipment, indicate that such work has been coordinated, regardless of the Section under which the adjacent items will be supplied and installed.
- E. Confirm dimensions shown on CONTRACTOR's drawings with actual measurements of existing and/or completed associated structures and affected adjacent work.
- F. Submit the number of opaque reproductions of CONTRACTOR's drawings which CONTRACTOR requires, plus 2 copies which will be retained by ENGINEER.
- G. CONTRACTOR's drawings which are submitted to ENGINEER for review will be returned to CONTRACTOR stamped and noted as being "Reviewed" by ENGINEER before fabrication or construction commences.
- H. One print of each drawing will be returned stamped and noted as "Reviewed" by ENGINEER, or marked up to show ENGINEER's required modifications and noted as "Revise and Re-Submit".

Correct and resubmit drawings as often as necessary until ENGINEER returns drawings without marked modifications and stamped "Reviewed". Upon receipt of drawings stamped "Reviewed", produce copies and distribute in accordance with Article 1.2 and for Record Documents purposes as described in Article 1.15.

- I. CONTRACTOR shall not be relieved of any part of his responsibilities for correctness of his drawings or adequacy of his design bearing ENGINEER's "Reviewed" stamp. ENGINEER's review is for the sole purpose of ascertaining conformance with general design concepts, and in no way constitutes approval of the detail design inherent in CONTRACTOR's drawings, responsibility for which remains solely with CONTRACTOR. Drawings prepared by CONTRACTOR's Representatives including Subcontractors, Suppliers, and vendors shall be considered CONTRACTOR's drawings.

1.6 PRODUCT DATA

- A. Submit the number of copies which CONTRACTOR requires, plus 2 copies which will be retained by ENGINEER.
- B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Contract.
- C. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. After review, distribute in accordance with Article 1.2 and provide copies for Record Documents as described in Article 1.15.

1.7 SAMPLES

- A. Submit samples to illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- B. Submit samples of finishes, textures, and patterns for ENGINEER's selection.
- C. Include identification on each sample, with full Contract information.
- D. Submit the number of samples specified in individual Sections; 1 of which will be retained by ENGINEER.
- E. Reviewed samples which may be used in Works are indicated in individual Sections.

1.8 MANUFACTURER INSTALLATION INSTRUCTIONS

- A. When specified in individual Sections, submit printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing, to ENGINEER in quantities as specified for product data in Article 1.6.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.9 MANUFACTURER CERTIFICATES

- A. When specified in individual Sections, or when required by reference standards, submit certification by manufacturer and/or test results to ENGINEER, in quantities as specified for product data in Article 1.6.
- B. Indicate that material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications, as appropriate.
- C. Certificates may be recent or previous test results on material or product, but shall be acceptable to ENGINEER.

1.10 CONSTRUCTION PHOTOGRAPHS

- A. Each month submit photographs as directed by ENGINEER.
- B. Photographs: 2 prints; color, glossy; 8 by 10 inch size; mounted on 8 1/2 by 11-inch soft card stock, with left edge binding margin for 3-hole punch.
- C. Take 4 Site photographs from differing directions indicating the relative progress of Works, 3 days maximum prior to submitting.
- D. ENGINEER will advise CONTRACTOR in writing, describing project locations and subjects to be photographed, which will not be limited to work performed under this Contract.
- E. Each photograph shall contain at least 1 person or other easily identifiable object properly located to effectively illustrate dimensional scale of work being photographed.
- F. Camera equipment, film, and development used shall be type best suited to produce glossy enlargement prints that are sharp and show details clearly.
- G. Identify photographs with date, time, orientation, project identification, and description provided by ENGINEER.
- H. Repeat information contained on back of each photographic print on sleeve of negatives.
- I. Minimum Size of Negatives: 2 1/4 by 2 1/4 inch unless otherwise specified by ENGINEER.
- J. Permission for CONTRACTOR to use progress photographs will be subject to approval of ENGINEER.

1.11 PROJECT ORGANIZATION CHART

- A. Submit with Bid a project organization chart identifying major positions and names of persons assigned to these positions, including the off-Site project manager.

1.12 SUBMITTALS FOR PROGRESS MEETINGS

A. At least 24 hours prior to scheduled progress meetings submit the following:

1. Updated job progress schedules detailing all activities. Include review of progress with respect to previously established Milestones and schedules, major problems and action taken, injury reports, equipment breakdown, material removal, and air sampling results conducted by CONTRACTOR.
2. Copies of transport manifests, trip tickets, and disposal receipts for waste materials removed from the work area.
3. Weekly copies of Site entry and work area logbooks with information on worker and visitor access.
4. Weekly logs documenting filter changes on HEPA vacuums, and other engineering controls.
5. Weekly results of collected air sampling data, including OSHA compliance air monitoring results.
6. Any other information required by ENGINEER or relevant to the agenda for the upcoming progress meeting.

1.13 SITE LAYOUT

A. Within 14 days after the date of Notice to Proceed and prior to mobilization to Site, submit Site layout drawings, showing existing conditions and facilities and construction facilities and temporary controls to be provided by CONTRACTOR including but not limited to the following:

1. Existing property lines, structures, roads, utilities, and any other existing Site feature or facility.
2. Temporary access roads and utilities to be constructed.
3. Offices and sheds.
4. Equipment and personnel decontamination areas.
5. The means of ingress and egress and temporary traffic control facilities.
6. Equipment and material staging areas.
7. Soil and demolition debris stockpile areas.
8. Exclusion Zones, Contaminant Reduction Zones, and other zones specified in CONTRACTOR's Site-specific Health and Safety Plan.
9. Grading, including contours, required to construct temporary construction facilities.
10. Wastewater treatment facilities.

11. Any other data deemed pertinent by CONTRACTOR or required by ENGINEER.

1.14 RECORD DOCUMENTS

- A. Maintain on Site 1 set of the following Record Documents; record actual revisions to Works:
 - 1. As-Built Drawings.
 - 2. Specifications.
 - 3. Change Orders and other modifications to Contract.
 - 4. Reviewed Shop Drawings, product data, and samples.
 - 5. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by TRUST.
- C. Store Record Documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each Section, a description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Change Order and modifications.
- F. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of Works.
 - 3. Field changes of dimension and detail.
 - 4. Details not on original Drawings.
- G. Remove ENGINEER title block and seal from Record Documents generated by CONTRACTOR.
- H. Submit all record documents including final as-built drawings and surveys to ENGINEER prior to Preliminary Acceptance of Works.

1.15 OPERATION AND MAINTENANCE DATA

- A. Submit data bound in 8 1/2 by 11-inch text pages, 3-D side ring binders with durable plastic covers.
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
- C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on 24-pound white paper, in 3 parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of ENGINEER, CONTRACTOR, Subcontractors, and major equipment Suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by Section. For each category identify names, addresses, and telephone numbers of Subcontractors and Suppliers. Identify the following:
 - 1. Significant design criteria.
 - 2. List of equipment.
 - 3. Parts list for each component.
 - 4. Operating instructions.
 - 5. Maintenance instructions for equipment and systems.
 - 6. Maintenance instructions for finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
 - 3. Part 3: Project documents and certificates, including the following:
 - 1. Shop Drawings and product data.
 - 2. Air and water balance reports.
 - 3. Certificates.
 - 4. Photocopies of warranties and Bonds.
- E. Submit 2 draft copies of completed volumes within 30 days prior to Preliminary Acceptance of Works. One copy will be reviewed and returned within 15 days prior to such Preliminary Acceptance of Works, with ENGINEER comments. Revise content of document sets as required prior to final submission.
- F. Submit 4 sets of revised final volumes within 10 days prior to Preliminary Acceptance of Works.

1.16 WARRANTIES

- A. Submit duplicate notarized copies.
- B. Execute and assemble transferable warranty documents from Subcontractors, Suppliers, and manufacturers.
- C. Submit Table of Contents and assemble in 3-D side ring binder with durable plastic cover.
- D. Submit within 30 days prior to Preliminary Acceptance of Works.
- E. For items of Works delayed beyond the specified date for Preliminary Acceptance of Works, furnish updated submittal within 10 days prior to Preliminary Acceptance of the affected item. The date of Preliminary Acceptance of such item shall be the start of warranty period for that item.

1.17 SUMMARY OF MAJOR PROJECT SUBMITTALS

- A. In addition to the submittals specified in this Section, submit the following submittals to ENGINEER for review:

	<i>Name of Submittal</i>	<i>Specification Cross-Reference</i>	<i>Due Date</i>
1.	Site-specific Health and Safety Plan	Section 01111	15 days after Notice to Proceed
3.	Detailed Landfill Development Plan	Section 02222	15 days after Notice to Proceed
4.	Detailed Stabilization Plan	Section 02240	15 days after Notice to Proceed
5.	Analytical Quality Assurance Project Plan	Sections 02750	15 days after Notice to Proceed
6.	Detailed Wastewater Treatment Plan	Section 02757	15 days after Notice to Proceed
7.	Erosion and Sediment Control Plan	Section 02276	15 days after Notice to Proceed
8.	Drum/Container Removal Plan	Section 02126	15 days after Notice to Proceed

- B. ENGINEER reviewed submittals will be submitted to USEPA for review and approval.

1.18 SCHEDULE OF SUBMITTALS

- A. Submit a Schedule of Submittals within 7 days after the date of Notice to Proceed.

B. Schedule of Submittals shall be in tabular form listing all submittals which are required by Contract Documents and the date on which CONTRACTOR will make each submittal. As a minimum, Schedule of Submittals shall consist of the following columns:

- | | | |
|----|-----------------------------|---|
| 1. | Submittal Number: | Number consecutively. |
| 2. | Section No.: | Section number or description of location in Contract Documents where submittal is requested. |
| 3. | Page No.: | Page number of Section in Contract Documents where submittals is requested. |
| 4. | Item: | Description of item or items to which submittals pertains. |
| 5. | Submittal Type: | A letter code indicating what type of submittal was requested. The type key shall be as follows:

A - Test Results and/or Certificates
B - Manufacturer's Literature or Data (Informative only)
C - Shop Drawings
D - Operation and Maintenance Instructions
E - Samples
F - Alternative Product Supporting Data
G - Administrative such as schedules, etc. |
| 6. | Deficiencies: | Manner in which submittal or proposed alternative product does not meet the requirements of Contract Documents. |
| 7. | Anticipated Submittal Date: | Date on which CONTRACTOR anticipates submittal to be delivered to ENGINEER. |
| 8. | Response Required: | Indicate "yes" if CONTRACTOR anticipates response from ENGINEER and "no" if no response is anticipated. |

END OF SECTION

SECTION 01400
QUALITY CONTROL

1.1 SECTION INCLUDES

- A. Quality assurance - control of installation.
- B. Tolerances.
- C. References.
- D. Inspecting and testing by TRUST.
- E. Inspecting and testing by CONTRACTOR.
- F. Manufacturers' field services and reports.
- G. Measurement and payment.

1.2 QUALITY ASSURANCE - CONTROL OF INSTALLATION

- A. Monitor quality control over Suppliers, manufacturers, products, services, Site conditions, and workmanship, to produce Works of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from ENGINEER before proceeding.
- D. Comply with specified standards as minimum quality for Works except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform work by persons qualified to produce workmanship of specified quality. Use persons licensed to perform Works where required by these Specifications or Laws and Regulations.
- F. Secure products and Works in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
- G. Materials furnished and finished or intermediate stages of Works shall be sampled, tested, and inspected as specified in individual Sections and as required by reference standards.
- H. Performance of tests or observations by ENGINEER or TRUST are for the sole benefit of ENGINEER and TRUST and are not intended to replace CONTRACTOR's quality control program. CONTRACTOR is solely responsible for establishing and implementing a quality control program to ensure that Works are in accordance with Contract Documents.

- I. It is CONTRACTOR's responsibility to notify ENGINEER when CONTRACTOR believes Works (or intermediate stages or parts of Works) are of specified quality and to permit ENGINEER or TRUST to perform independent tests or analyses.
- J. Testing by ENGINEER or failure to detect defective work shall not prevent rejection when defect is discovered, nor shall it obligate TRUST for final acceptance.

1.3 TOLERANCES

- A. Monitor tolerance control of installed products to produce acceptable Works. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from ENGINEER before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue in effect as of bid closing date, except where a specific date is established by code or by individual Section.
- C. No inference or provision of any reference document including but not limited to any standard specification, manual, or code shall be effective to change the relationships, duties, and responsibilities of TRUST, CONTRACTOR, or ENGINEER from those set forth in Contract Documents, nor shall it be effective to assign to TRUST or ENGINEER any duty or authority to supervise or direct the furnishing or performance of Works or any duty or authority to undertake responsibility inconsistent with the provisions of this Contract.
- D. Publications referred to in these Specifications form part of Specifications to the extent specified in individual Sections.
- E. In case of conflict or discrepancy between a reference standard and Project Specifications or with another reference standard, the more stringent requirements shall apply.

1.5 INSPECTING AND TESTING BY TRUST

- A. TRUST may engage the services of an independent inspecting and testing firm to perform inspections, tests, or approvals required by Contract Documents except as otherwise specifically provided in Contract Documents.
- B. Employment of independent inspecting and testing firm and services performed by such firm in no way relieves CONTRACTOR of obligation to perform Works in accordance with requirements of Contract Documents.

- C. Independent firm engaged by TRUST will perform inspections, tests, and other services specified in individual specification Sections and as required by ENGINEER or TRUST.
- D. Cooperate with personnel of independent inspecting and testing firm, and provide safe access to Works.
- E. Provide incidental labor and facilities:
 - 1. To provide access to Works to be tested.
 - 2. To obtain and handle samples at Site or at source of products to be tested.
 - 3. To facilitate tests and inspections.
 - 4. To provide storage and curing or preservation, as required, of test samples.
- F. Notify ENGINEER 24 hours prior to expected time for operations requiring inspecting and testing services.
- G. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by ENGINEER. Costs for retesting and reinspection will be payable by CONTRACTOR to TRUST on demand or TRUST may deduct cost of reinspecting or retesting charges from monies which are due or may become due CONTRACTOR.

1.6 INSPECTING AND TESTING BY CONTRACTOR

- A. CONTRACTOR shall employ and pay for services of an independent and qualified inspecting and testing firm to perform inspecting and testing services as specified in individual Sections.
- B. Employment of independent inspecting and testing firm and services performed by such firm in no way relieves CONTRACTOR of obligation to perform Works in accordance with requirements of Contract Documents.
- C. The independent firm shall perform inspections, tests, and other services specified in individual Sections and as required by ENGINEER or TRUST.
- D. Inspecting, testing, and source quality control may occur on or off Site.
- E. Reports shall be submitted by the independent firm to ENGINEER, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
- F. Furnish to laboratory at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
- G. Cooperate with personnel of independent inspecting and testing firm, and provide safe access to Works.
- H. Provide incidental labor and facilities:
 - 1. To provide access to Works to be tested.

2. To obtain and handle samples at Site or at source of products to be tested.
 3. To facilitate tests and inspections.
 4. To provide storage and curing of test samples.
- I. Notify ENGINEER 24 hours prior to expected time for operations requiring inspecting and testing services.
 - J. Make arrangements with independent firm and pay for additional samples and tests required for CONTRACTOR's use.
 - K. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by ENGINEER. Costs for retesting and reinspection shall be payable by CONTRACTOR to TRUST on demand or TRUST may deduct cost of reinspecting or retesting charges from monies which are due or may become due CONTRACTOR.
 - L. If defects or deficiencies are revealed during testing or inspecting, correct such defects and deficiencies.
 - M. Laboratory: Authorized to operate in the state in which Site is located.
 - N. Laboratory Staff: Maintain a full-time specialist on staff to review services.
 - O. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.
 - P. Prior to start of Works, submit testing laboratory name, address, and telephone number, and names of full-time specialist and responsible officer.
 - Q. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - R. Test samples of mixes submitted by CONTRACTOR.
 - S. Provide qualified personnel at Site. Cooperate with ENGINEER and CONTRACTOR in performance of services.
 - T. Perform specified inspecting, sampling, and testing of products in accordance with specified standards.
 - U. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - V. Promptly notify ENGINEER and CONTRACTOR of observed irregularities or non-conformance of Works or products.
 - W. Perform additional inspection and tests required by ENGINEER.
 - X. Attend preconstruction meetings and progress meetings, as required.

Y. **Laboratory Reports:** After each inspection and test, promptly submit 2 copies of laboratory report to ENGINEER and to CONTRACTOR including:

1. Date issued.
2. Contract title and number.
3. Name of inspector.
4. Date and time of sampling or inspection.
5. Identification of product and specifications Section.
6. Location in the project.
7. Type of inspection or test.
8. Date of test.
9. Results of tests.
10. Conformance with Contract Documents.

Z. When requested by ENGINEER, provide interpretation of test results.

AA. **Limits on Testing Laboratory Authority:** Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents; approve or accept any portion of Works; or assume any duties of CONTRACTOR. Laboratory has no authority to stop Works.

1.7 MANUFACTURERS' FIELD SERVICES AND REPORTS

- A. When specified in individual Sections, require Suppliers or manufacturers to provide qualified staff personnel to observe Site conditions, conditions of surfaces and installation, quality of workmanship, startup of equipment, test, adjust, and balance of equipment and calibrate equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to ENGINEER 30 days in advance of required observations. Observer subject to approval of TRUST.
- C. Report observations and Site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- D. Submit report in duplicate within 14 days of observation to ENGINEER for information.

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

1.1 SECTION INCLUDES

- A. Temporary Utilities: Electricity, lighting, heat, telephone service, facsimile service, photocopier, Site communication, potable water service, and sanitary facilities.
- B. Construction Facilities: Progress cleaning and waste removal, project signs, and temporary facilities including field offices and sheds, Equipment Decontamination Facility, Personnel Hygiene/Decontamination Facility, Emergency First-aid Facility, portable toilets, storage/stockpiling facilities, wastewater treatment, wastewater storage tanks, drums, barriers, fencing, security, access roads, parking and traffic regulation.
- C. Temporary Controls: Water control, dewatering, erosion and sediment control, noise control, dust and particulate control, pollution control, protection of installed work, and equipment decontamination.
- D. Measurement and payment.

1.2 TEMPORARY ELECTRICITY

- A. Provide and maintain temporary power service necessary for performance of Works.
- B. Route utility line along alignments approved by ENGINEER. Take necessary precautions to prevent service interruptions due to accidental breakage of utility lines. Coordinate installation with local utility company and comply with Laws and Regulations and National Electric Code.
- C. Provide power outlets for construction operations, with branch wiring and distribution boxes located as necessary. Provide flexible power cords as necessary.
- D. Provide main service disconnect and over current protection at convenient locations, feeder switch at source distribution equipment and meter.

1.3 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain sufficient lighting for construction operations.
- B. Provide and maintain a minimum 1 watt/sq ft lighting to exterior staging and storage areas and exterior decontamination areas after dark for security purposes.
- C. Maintain lighting and make routine repairs.
- D. Permanent building lighting may be utilized during construction.

1.4 TEMPORARY HEAT

- A. Provide heating devices and heat as needed to maintain specified conditions for construction operations and to protect Works and material against damage by dampness, cold, and freezing, and to facilitate completion of Works.
- B. Provide attendance, fuel, equipment, and material required for temporary heating.

1.5 TELEPHONE SERVICE

- A. Provide and maintain separate telephone service and equipment including 1 telephone unit and 1 answering machine to each of CONTRACTOR's field office, ENGINEER's field office, USEPA field office and security guard office at time of mobilization to Site.
- B. TRUST will pay for long distance charges made from ENGINEER's, USEPA's and security guard phones.
- C. Provide in prominent location post near each phone, emergency numbers including police, fire, ambulance, hospital, poison control center, and appropriate regulatory agencies.

1.6 FACSIMILE SERVICE

- A. Provide and maintain, and pay for separate facsimile service and a dedicated telephone line to each of ENGINEER's field office and USEPA's field office for their respective use.
- B. TRUST will pay for long distance charges for ENGINEER's and USEPA's facsimiles.
- C. Complete installation at time of mobilization to Site.
- D. Fax Machine: Xerox 7041 or equivalent plain paper fax machine capable of sending and receiving separate 8 1/2 by 11-inch and 8 1/2 by 14-inch sheets of plain paper.
- E. TRUST will be responsible for supply of paper for fax machine in ENGINEER's and USEPA's field offices.
- F. Equip CONTRACTOR's office with facsimile service.

1.7 PHOTOCOPIER

- A. Provide and maintain a photocopier to ENGINEER's field office and USEPA's field office for their respective use.
- B. Photocopier: Xerox 5028 or equivalent capable of making photocopies onto 8 1/2 by 11-inch, 8 1/2 by 14-inch, and 11 by 17-inch sheets of plain paper.
- C. TRUST will be responsible for supply of photocopy paper for photocopier in ENGINEER's field office.

1.8 SITE COMMUNICATIONS

- A. Furnish and maintain, for the exclusive use of ENGINEER, a minimum of 3 two-way portable radios for Site communications capable of clearly transmitting and receiving communications over a 1-mile radius.
- B. Radio Frequencies: Same as those set for the radios used by CONTRACTOR.
- C. Equip key CONTRACTOR personnel with two-way portable radios. Furnish portable radios as a minimum to the following CONTRACTOR personnel:
 - 1. Superintendent.
 - 2. Health and Safety Officer.
 - 3. Security personnel.
 - 4. Each crew foreman.

1.9 TEMPORARY WATER SERVICE

- A. Provide and maintain suitable quality water service as required. Connection to existing potable water source for construction operations will be at CONTRACTOR's expense.
- B. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide pipe insulation to prevent freezing, as required.
- C. Connections to TRUST's Source: Include backflow protection valves which are temperature and pressure rated for operation at the temperatures and pressures encountered; after completion of use, remove connections and fittings without damage or alteration to existing water piping and equipment.
- D. Provide and maintain suitable bottled drinking water service for each field office.

1.10 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required temporary sanitary facilities and enclosures in accordance with OSHA.

1.11 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations, contamination or demolition.
- B. Provide protection for plant life designated to remain. Replace damaged plant life.

- C. Protect vehicular traffic, stored materials, Site, and structures from damage.

1.12 TEMPORARY FENCING

- A. Construction: Commercial grade chain link fence.
- B. Maintain 6-foot high fence around construction site; equip with vehicular gates with locks.
- C. Inspect perimeter fence on a weekly basis and repair as necessary.
- D. Enforce and require that workers observe and respect the limits marked with temporary fencing.

1.13 WATER CONTROL

- A. Grade Site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect Site from puddling or running water.
- C. Prevent surface water runoff from leaving work areas.
- D. Do not discharge decontamination water, or surface water runoff, or groundwater which may have come in contact with potentially contaminated material, off Site or to municipal sewers.
- E. Provide, operate, and maintain necessary equipment appropriately sized to keep excavations, the staging pads, and other work areas free from water.
- F. At all times have on hand sufficient pumping equipment, machinery, and tankage in good working condition for ordinary emergencies, including power outage, and have available at all times competent workers for the operation of the pumping equipment.
- G. Prevent precipitation from infiltrating or from directly running off stockpiled materials. Cover stockpiled materials with an impermeable liner during periods of work stoppage including at the end of each working day and as directed by ENGINEER.
- H. Contain water from stockpiled materials and transfer the collected water to the wastewater storage tanks separate from the wastewater from the personnel hygiene/decontamination facility.
- I. Direct surface waters that have not contacted potentially contaminated materials to existing surface drainage systems.
- J. Control surface drainage including ensuring that gutters are kept open at all times, water is not directed across or over pavements or sidewalks except through approved pipes or properly constructed troughs, and runoff from unstabilized areas is intercepted and diverted to a suitable outlet.
- K. Dispose of water in a manner not injurious to public health or safety, to property, or to any part of Works completed or under construction.

- L. Contain and collect surface water runoff from potentially contaminated materials.
- M. Contain and collect groundwater.

1.14 DEWATERING

- A. Dewater the various parts of Works including, without limitation, excavations, structures, foundations, and work areas.
- B. Employ construction methods, plant, procedures, and precautions that will ensure Works, including excavations, are stable, free from disturbance, and dry.
- C. Dewatering Methods: Includes sheeting and shoring; groundwater control systems; surface or free water control systems employing ditches, diversions, drains, pipes and/or pumps; and any other measures necessary to enable the whole of Works to be carried out in the dry.
- D. Provide sufficient and appropriate labor, plant, and equipment necessary to keep Works free of water including standby equipment necessary to ensure continuous operation of dewatering system.
- E. Take precautions necessary to prevent uplift of any structure or pipeline and protect excavations from flooding and damage due to surface runoff.

1.15 EROSION AND SEDIMENT CONTROL

- A. Plan and execute construction by methods to control surface drainage from cuts and fills, from stockpiles, staging areas, and other work areas and to prevent erosion and sedimentation.
- B. Minimize amount of soil exposed at one time. Stabilize disturbed soils as quickly as practical. Strip vegetation, regrade, or otherwise develop in such a way as to minimize erosion. Remove accumulated sediment resulting from construction activity from adjoining surfaces, drainage systems, and water courses, and repair damage caused by soil erosion and sedimentation as directed by ENGINEER.
- C. Provide and maintain temporary measures which may include, but are not limited to, silt fences, hay or straw bales, ditches, geotextiles, drains, berms, terracing, riprap, temporary drainage piping, sedimentation basins, vegetative cover, dikes, and any other construction required to prevent erosion and migration of silt, mud, sediment, and other debris off of Site or to other areas of Site where damage might result or that might otherwise be required by Laws and Regulations. Make sediment control measures available at all times during construction. Place silt fences and/or hay bales in ditches to prevent sediments from escaping from the ditch terminations.
- D. Hay or Straw Bale:
 - 1. Wire bound or string tied.
 - 2. Securely anchored by at least 2 stakes or rebars driven through the bale 12 to 18 inches (300 to 460 mm) into the ground.

3. Chinked (filled by wedging) with hay or straw to prevent water from escaping between the bales.
4. Entrenched a minimum of 4 inches into the ground.

E. Silt Fence:

1. An assembled, ready to install unit consisting of geotextile attached to driveable posts.
2. Geotextile: Uniform in texture and appearance having no defects, flaws, or tears that would affect its physical properties. Contain sufficient ultraviolet ray inhibitor and stabilizers to provide a minimum 2-year service life from outdoor exposure.
3. Net Backing: Consist of an industrial polypropylene mesh which is joined to the geotextile at both top and bottom with double stitching of heavy-duty cord. Width of netting: minimum of 2 1/2 feet.
4. Posts: Sharpened wood approximately 2 inches square and protrude below the bottom of geotextile to allow a minimum of 1 1/2 feet embedment. Post spacing: not to exceed 8 feet. Securely fasten each post to the geotextile and net backing by staples suitable for such purpose.

F. Plan construction procedures to avoid damage to or work or equipment encroachment onto water bodies or drainage ditch banks. In the event of damage, promptly take action to mitigate the effects of such damage. Restore the affected bank or water body to its existing condition.

G. Installation:

1. Construct temporary erosion control items in accordance with the typical sections and elevation controls shown on Drawings. Actual alignment and/or location of the various items as directed by ENGINEER.
2. Do not construct straw bale barriers and silt fence in flowing streams or in swales where there is the possibility of a washout.
3. Check weekly and after each rainfall erosion and sediment control measures. During prolonged rainfall, check daily.
4. Straw bales and/or silt fence may be removed at the beginning of the work day, but shall be replaced at the end of the work day.
5. Whenever sedimentation is caused by stripping vegetation, regrading, or other development, remove it from adjoining surfaces, drainage systems, and watercourses, and repair damage as quickly as possible.
6. Prior to or during construction, ENGINEER may require the installation or construction of improvements to prevent or correct temporary conditions on Site. Improvements may include berms, mulching, sediment traps, detention and retention basins, grading, planting, retaining walls, culverts, pipes, guardrails, temporary roads, and other measures

appropriate to the specific condition. Temporary improvements shall remain in place and in operation as necessary or until otherwise directed by ENGINEER.

7. Pay close attention to the repair of damaged bales, end runs, and undercutting beneath bales.
8. Unless otherwise specified on Drawings or directed by ENGINEER, remove temporary erosion and sediment control devices upon completion of Works. Spread accumulated sediments to form a suitable surface for seeding or dispose of, and shape the area to permit natural drainage; all to the satisfaction of ENGINEER. Materials once removed become the property of CONTRACTOR.

H. Construct fill by selective placements to avoid erosive surface silts or clays.

I. Do not disturb existing embankments or embankment protection.

J. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

K. Unless specified otherwise, provide erosion and sediment control in accordance with State of Ohio regulations.

L. If soil and debris from Site accumulate in low areas, storm sewers, roadways, gutters, ditches, or other areas where in TRUST's or ENGINEER's determination it is undesirable, remove the accumulation and restore the area to its original condition.

1.16 NOISE CONTROL

A. Provide methods, means, and facilities to minimize noise from construction operations.

B. If machinery, motors, pumps, and other similar equipment must be operated beyond the normal working hours, keep the noise below a level acceptable to ENGINEER by housing the equipment as necessary.

C. Equip vehicles and equipment with sufficient muffling devices. Provide and use devices that will minimize noise levels in the construction area. Adhere to local noise Laws and Regulations.

1.17 DUST AND PARTICULATE CONTROL

A. Provide and maintain dust and particulate control measures such as a water misting system as required to prevent the generation of dust and particulate.

B. ENGINEER may stop work at any time when CONTRACTOR's control of dusts and particulates is inadequate for the wind conditions present at Site, or when the air quality monitoring indicates that the release of fugitive dusts and particulates from Site equals or exceeds the specified levels.

C. Implement and maintain dust and particulate control measures during construction and in accordance with State of Ohio regulations and the action levels specified in Section 02240.

- D. Use potable water for dust and particulate control.
- E. Do not use chemical means for dust and particulate control without ENGINEER's prior written approval.
- F. As a minimum, use appropriate covers on trucks hauling fine or dusty material and use watertight vehicles to haul wet materials.
- G. Control dust so as not to be a nuisance to adjacent property owners or occupants.
- H. In the event that CONTRACTOR's dust and particulate control is not sufficient for controlling dusts and particulates from and within Site, work causing the excursion shall be discontinued and a meeting shall be held between ENGINEER and CONTRACTOR to discuss the procedures that CONTRACTOR proposes to resolve the problem. Make all necessary changes to operations prior to resuming any excavation, handling, processing, or any other work that may cause a release of dusts or particulates.

1.18 POLLUTION CONTROL

- A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious toxic substances and pollutants produced by construction operations.
- B. Be prepared to intercept, clean up, and dispose of spills or releases that may occur whether on land or water. Maintain materials and equipment required for cleanup of spills or releases readily accessible on Site.
- C. Promptly report spills and releases potentially causing damage to the environment to:
 - 1. Authority having jurisdiction or an interest in the spill or release including any conservation authority, water supply authorities, drainage authority, road authority, fire department, etc.
 - 2. The owner of the pollutant, if known.
 - 3. The person having control over the pollutant, if known.
 - 4. ENGINEER.
- D. Contact the manufacturer of the pollutant if known and ascertain the hazards involved, precautions required, and best measures to be used in any cleanup or mitigating action.
- E. Take immediate action using available resources to contain and mitigate the effects on the environment and persons from any spill or release.
- F. Volatile Organic Control:
 - 1. In addition to requirements of Section 01111, monitor air quality for volatile organics at the security fence every other hour during contaminated materials excavation and management activities, and maintain a log of the air quality readings. If at any time the air quality monitoring indicates that the release of volatile organics in the air at the Site

boundary exceeds the Level C threshold for air quality, implement corrective actions to control volatile organics. If actions are not sufficient to control the release of volatile organics within an hour of identification of the air quality problem, the work resulting in the excessive volatile organic emissions will be suspended and a meeting will be held between ENGINEER and CONTRACTOR to discuss the additional methods that CONTRACTOR proposes to control the release of volatile organics. Make all necessary changes at no additional cost to TRUST prior to resuming Works.

2. In addition, if ENGINEER's monitoring of the ambient air at Site perimeter indicates unacceptable concentrations of contaminants in the air, modify operations to minimize such off-Site impacts.

1.19 PROTECTION OF INSTALLED WORK

- A. Protect installed work and provide special protection where specified in individual Sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic upon landscaped areas.
- G. Maintenance of Flow: Maintain the flow of water in the water distribution system and in existing sewers, drains, and watercourses. In the event that any emergency or situation should arise which requires interruption of normal operation of any existing systems, restore normal operation as soon as possible even though permission for such planned shutdown was obtained.
- H. Flotation: Take necessary precautions against the flotation of any structures during construction. Make good any damage caused by flotation.

1.20 SECURITY

- A. Maintain security program throughout construction period by ensuring that existing fence is in good repair and that gates and other access points are secured prior to the termination of work activities each day. CONTRACTOR is responsible for the security and safety of on-Site personnel, the Site and on-Site equipment.
- B. The TRUST will provide one gatekeeper at the main Site entrance during working hours to maintain visitor and traffic log.

- C. Provide warning signs that read "Warning. Do Not Enter. Hazardous Substances Present." Measuring approximately 4 feet by 8 feet posted in plain view, secured to the fence at each gate or access point to the Site.
- D. Initiate security program at time of mobilization to Site.
- E. Maintain security program throughout construction period until directed by ENGINEER.
- F. Restrict access of persons and vehicles into Site and existing facilities.
- G. Allow entrance only to authorized persons with proper identification.
- H. Maintain log of workers and make available to ENGINEER on request. Include date, name, address, company employed by, company/person visited, time in and time out for each person, and record of deliveries and security incidents.
- I. Do not allow cameras on Site or photographs taken except by prior written approval of TRUST or ENGINEER.
- J. If unauthorized personnel are observed on Site, notify ENGINEER and, if so directed by ENGINEER, call upon the appropriate law enforcement officials for proper legal actions.
- K. Do not permit visitors to enter the area secured by Site security fence without the express permission of Health and Safety Officer and ENGINEER; require visitors to complete training in accordance with Site-specific Health and Safety Plan prior to gaining access to the secured areas.
- L. Check that the perimeter fencing and warning signs are secure and intact on a daily basis; if deterioration of Site security fence is observed, or if warning signs are found to be removed, bring the situation to the attention of ENGINEER and immediately rectify.
- M. Keep access gate to Site closed except for passage of authorized personnel and vehicles.

1.21 ACCESS ROADS

- A. Construct and maintain temporary all-weather access roads from public thoroughfares and Site roadways to construction area at a width and load bearing capacity to provide unimpeded access for construction purposes as CONTRACTOR requires for performance of Works.
- B. Construct and maintain temporary bridges and culverts to span low areas and allow unimpeded drainage.
- C. Extend and relocate temporary roads as work progress requires. Provide detours as necessary for unimpeded traffic flow.
- D. Provide unimpeded access for emergency vehicles. Maintain sufficient width and turning space.
- E. Provide and maintain access to fire hydrants and control valves, free of obstructions.
- F. Remove mud from vehicle wheels before entering public roads.

- G. Existing on-Site roads may be used for construction traffic.
 - H. Maintain access roads in a sound condition and properly graded, free of ruts, washboard, potholes, ponding, ice, snow, mud, any soft material, and free of excavated material, construction equipment, and products. Maintain access roads throughout Contract period to ensure unimpeded access at all times for passenger automobiles as well as construction vehicles. CONTRACTOR will be permitted reasonable use of existing access roads at Site subject to the following conditions:
 - 1. Do not interrupt or interfere with traffic on roads or parking areas at any time except where open-trench crossings are specified on Drawings and proper notice regarding open-trench crossings has been given to ENGINEER.
 - 2. Comply with weight and load size restrictions where applicable.
 - I. Maintain existing and permanent paved areas used for construction; promptly remove standing water and repair breaks, potholes, low areas, and other deficiencies, to maintain paving and drainage in original or specified condition.
 - J. Obtain ENGINEER's prior approval for location and extent of temporary roads.
 - K. Construction of Access Roads: Includes such improvement of existing roads as CONTRACTOR may require to perform Works. Repair wear and tear and damage to access roads.
 - L. Maintenance of Access Roads: Includes provision of signs, barricades, gatepersons, flagpersons, flares and lights, and other measures required; provide flagpersons for construction traffic crossing or entering local traffic routes or otherwise required on Site.
 - M. ENGINEER may collect soil samples for chemical analyses from the traveling surfaces of constructed and existing access routes prior to, during, and upon completion of Works. Excavate and dispose of clean soil contaminated by CONTRACTOR's activities at no additional cost to TRUST.
 - N. Take appropriate measures to prevent contamination of access roads and other clean areas during performance of Works. Immediately scrape up debris or material on access roads which is suspected to be contaminated as determined by ENGINEER; transport and place into designated area approved by ENGINEER. Clean access roads at least once per shift.
 - O. Repair existing facilities damaged by use to original condition.
 - P. Existing Pavements: Use of existing on-Site roads used for construction traffic is permitted. Tracked vehicles are not allowed on paved areas.
- 1.22 PARKING
- A. Provide temporary gravel surface parking areas to accommodate construction personnel.
 - B. When Site space is not adequate, provide additional off-Site parking.
 - C. Locate parking areas as directed by ENGINEER.

- D. Designate 2 parking space for ENGINEER.
- E. Maintain separate parking area for construction equipment.
- F. Use of existing parking facilities by construction personnel is permitted.

1.23 TRAFFIC REGULATION

- A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles.
- B. Monitor parking at construction personnel's vehicles. Maintain vehicular access to and through parking areas.
- C. Prevent parking on or adjacent to access roads or in non-designated areas.
- D. Provide trained and equipped flagpersons to regulate traffic when construction operations or traffic encroach on public traffic lanes.
- E. Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.
- F. Consult with authority having jurisdiction; establish thoroughfares to be used for haul routes and Site access.

1.24 PROGRESS CLEANING AND WASTE REMOVAL

- A. Maintain areas free of waste materials, debris, trash, and rubbish. Maintain Site in a clean and orderly condition throughout the construction period.
- B. Pick up garbage, litter, debris, and other materials attributable to Works or the activities of CONTRACTOR's employees, Subcontractors, and Suppliers that accumulates on Site and property in the vicinity of Site.
- C. Collect waste materials, debris, and rubbish from Site and dispose of off Site weekly.

1.25 EQUIPMENT DECONTAMINATION

- A. Do not commence work involving equipment contact with potentially contaminated material until Equipment Decontamination Facility is operational.
- B. Decontaminate equipment after working in potentially contaminated work areas and prior to subsequent work or travel on clean areas.
- C. Perform equipment decontamination on CONTRACTOR-constructed equipment decontamination pad or on the existing equipment decontamination pad.

- D. At a minimum, perform the following steps during equipment decontamination:
1. Mechanically remove packed dirt, grit, and debris by scraping and brushing without the use of steam or high-pressure water to reduce the amount of water needed and to reduce the amount of contaminated rinsate generated.
 2. Use high-pressure, low-volume, hot water or steam supplemented by detergents or solvents as appropriate and as approved by ENGINEER.
 3. Pay particular attention to tire treads, equipment tracks, springs, joints, sprockets, and undercarriages.
 4. Scrub surfaces with long handle scrub brushes and a cleaning agent.
 5. Rinse off and collect cleaning agent.
 6. Air dry equipment in Clean Zone before removing from Site or travel on clean areas.
 7. Perform an assessment to determine the effectiveness of the decontamination as directed by ENGINEER.
- E. Maintain an inspection record on Site which includes:
1. Equipment descriptions with identification numbers or license plates.
 2. Time and date entering the decontamination facility.
 3. Time and date exiting the decontamination facility.
 4. Name of the inspector with comment stating that decontamination was performed and completed.
- F. Each piece of equipment will be inspected by ENGINEER after decontamination and prior to removal from Site and/or travel on clean areas. ENGINEER will have right to require additional decontamination to be completed if deemed necessary.
- G. Take appropriate measures necessary to minimize the drift of mist and spray during decontamination including the provision of wind screens.
- H. Collect decontamination wastewaters and sediments which accumulate on the equipment decontamination pad. Transfer wastewaters to designated wastewater storage tank.
- I. Transfer sediments to soil staging area.
- J. Furnish and equip personnel engaged in equipment decontamination with protective equipment including suitable disposable clothing, respiratory protection, and face shields.
- K. At all times have on hand sufficient pumping equipment, of adequate pumping capacity and associated machinery and piping in good working condition for ordinary emergencies, including power outage, and have available competent workers for the operation of the pumping

equipment. Maintain piping and connections in good condition and leak-free. Contain, collect, and clean up spills or releases which occur at Site.

1.26 PROJECT IDENTIFICATION

- A. Provide 8-foot wide by 6-foot high project sign of exterior grade plywood and wood frame construction, painted, with exhibit lettering by professional sign painter, to ENGINEER's design and colors.
- B. List title of Project, names of TRUST, ENGINEER, CONTRACTOR, and major Subcontractors.
- C. Erect on Site at location established by ENGINEER.
- D. No other signs are allowed without TRUST's prior written permission except those required by law.

1.27 FIELD OFFICES AND SHEDS

- A. Materials, Equipment, Furnishings: Serviceable, new or used, adequate for required purpose.
- B. Construction:
 - 1. Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors.
 - 2. Construction: Structurally sound, secure, weather tight enclosures for office and storage spaces. Maintain during progress of Works; remove when no longer needed.
 - 3. Temperature Transmission Resistance of Floors, Walls, and Ceilings: Compatible with occupancy and storage requirements.
 - 4. Exterior Materials: Weather resistant.
 - 5. Interior Materials in Offices: Sheet type materials for walls and ceilings, pre-finished or painted; resilient floors and bases.
 - 6. Lighting for Offices: 50 ft-candles at desk top height, exterior lighting at entrance doors.
 - 7. Fire Extinguishers: Appropriate type fire extinguisher at each office and each storage area.
 - 8. Interior Materials in Storage Sheds: As required to provide specified conditions for storage of products.
- E. Environmental Control:
 - 1. Heating, Cooling, and Ventilating for Offices: Automatic equipment to maintain 68 degrees F heating and 76 degrees F cooling.

2. Storage Spaces: Heating and ventilation as needed to maintain products in accordance with Contract Documents; adequate lighting for maintenance and inspection of products.

F. CONTRACTOR Office and Facilities:

1. Size: For CONTRACTOR's needs and to provide space for project meetings.
2. Telephone: As specified in Section 01500.
3. Furnishings in Meeting Area: Conference table and chairs to seat at least 10 persons; racks and files for Contract Documents, submittals, and Record Documents.
4. Other Furnishings: CONTRACTOR's option.
5. Equipment: 6 adjustable band protective helmets for visitors, one 10-inch (250 mm) outdoor weather thermometer.

G. ENGINEER Office:

1. Separate space for sole use of ENGINEER, with separate entrance door with new lock and 2 keys.
2. Area: Minimum 200 sq ft, minimum dimension 8 feet.
3. Windows: Minimum total area of 10 percent of floor area, with operable sash and insect screens. Locate to provide views of construction area.
4. Electrical Distribution Panel: 2 circuits minimum, 110 volt, 60 Hz service.
5. Minimum four 110 volt duplex convenience outlets, 1 on each wall.
6. Telephone: As specified in Section 01500.
7. Sanitary Facilities: Convenient access to private lavatory toilet facilities.
8. Drinking Fountain: Suitable for bottled water.
9. Furnishings:
 1. Two desks 54 by 30 inch, with 3 drawers.
 2. One drafting table 36 by 72 inch, with 1 equipment drawer.
 3. One metal double-door storage cabinet under table.
 4. Plan rack for project drawings.
 5. One standard 4-drawer letter size metal filing cabinet with locks and 2 keys per lock.
 6. Six linear feet of metal bookshelves.

7. Two swivel arm chairs.
8. Two straight chairs.
9. One drafting table stool.
10. One tackboard 36 by 30 inch.
11. One waste basket per desk and table.

H. USEPA Office:

1. Separate space for sole use of USEPA, with separate entrance door with new lock and 2 keys.
2. Area: Minimum 150 sq ft, minimum dimension 8 feet.
3. Windows: Minimum total area of 10 percent of floor area, with operable sash and insect screens. Locate to provide views of construction area.
4. Electrical Distribution Panel: 2 circuits minimum, 110 volt, 60 Hz service.
5. Minimum four 110 volt duplex convenience outlets, 1 on each wall.
6. Telephone: As specified in Section 01500.
7. Sanitary Facilities: Convenient access to private lavatory toilet facilities.
8. Drinking Fountain: Suitable for bottled water.
9. Furnishings:
 1. One desk 54 by 30 inch, with 3 drawers.
 2. One drafting table 36 by 72 inch, with 1 equipment drawer.
 3. One metal double-door storage cabinet under table.
 4. Plan rack for project drawings.
 5. One standard 4-drawer letter size metal filing cabinet with locks and 2 keys per lock.
 6. Six linear feet of metal bookshelves.
 7. One swivel arm chairs.
 8. Two straight chairs.
 9. One drafting table stool.
 10. One tackboard 36 by 30 inch.

11. One waste basket per desk and table.

I. Security Guard

1. Separate space for sole use of Guard, with separate entrance door with new lock and 2 keys.
2. Area: Minimum 60 sq ft, minimum dimension 6 feet.
3. Windows: Minimum total area of 10 percent of floor area, with operable sash and insect screens. Locate to provide views of construction area.
4. Electrical Distribution Panel: 2 circuits minimum, 110 volt, 60 Hz service.
5. Minimum four 110 volt duplex convenience outlets, 1 on each wall.
6. Telephone: *As specified in Section 01500.*
7. Sanitary Facilities: Convenient access to private lavatory toilet facilities.
8. Drinking Fountain: Suitable for bottled water.
9. Furnishings:
 1. One desk 54 by 30 inch, with 3 drawers.
 2. One swivel arm chairs.
 3. One straight chairs.
 4. One tackboard 36 by 30 inch.
 5. One waste basket per desk and table.

J. *Storage Area and Sheds: Size to storage requirements for products of individual Sections, allowing for access and orderly provision for maintenance and for inspection of products to requirements of Section 01600.*

K. Fill and grade sites for temporary structures to provide drainage away from buildings.

L. Install office spaces ready for occupancy 15 days after date fixed in Notice to Proceed.

M. Parking: 2 hard surfaced parking spaces for use by ENGINEER, connected to office by walk.

N. Provide weekly janitorial services for offices; periodic cleaning and maintenance for office and storage areas.

O. Maintain approach walks free of mud, water, and snow.

- P. At completion of Works remove buildings, foundations, utility services, and debris. Restore areas.

1.28 EQUIPMENT DECONTAMINATION FACILITY

- A. Prior to commencing work involving equipment contact with potentially contaminated materials, construct an equipment decontamination pad in accordance with the details shown on Drawings to accommodate the largest piece of on-Site potentially contaminated equipment. Upgrade of existing equipment decontamination pad is acceptable.
- B. Submit alternative equipment decontamination pad design for review prior to commencing construction.
- C. Provide, operate, and maintain suitable portable, high-pressure, low-volume decontamination wash unit(s) equipped with self-contained water storage tank and pressurizing system.
- D. Wash Unit(s): Capable of heating and maintaining wash waters to 180 degrees F and providing a nozzle pressure of 150 psi.
- E. Provide, operate, and maintain necessary equipment, pumps, and piping required to collect and contain equipment decontamination wastewater and sediment.
- F. Provide, operate, and maintain necessary equipment required to transfer decontamination wastewater and sediment accumulating on equipment decontamination pad to approved storage facilities.

1.29 PERSONNEL HYGIENE/DECONTAMINATION FACILITY

- A. Provide, operate, and maintain a Personnel Hygiene/Decontamination Facility which complies with the requirements of 29 CFR 1910.141 and contains, as a minimum, the following:
 - 1. Shower facilities with at least 1 shower for every 6 on-Site CONTRACTOR personnel.
 - 2. Locker room with 1 locker for each on-Site CONTRACTOR personnel plus 3 additional lockers for use by ENGINEER and regulatory agencies.
 - 3. A room where personal safety equipment and protective clothing can be stored.
 - 4. A room where personnel can eat or drink.
 - 5. Boot washing facility and boot rack for washed boots to drain.
 - 6. Toilet facilities with at least 1 toilet and 1 handbasin for every 6 on-Site CONTRACTOR personnel.
 - 7. Tank(s) for sanitary waste and wastewater and necessary pumping and piping from Personnel Hygiene/Decontamination Facility to the designated wastewater storage tanks.
 - 8. Potable water and wastewater pumping and piping.

- 9. Containers for storage of spent disposable personnel safety and protective equipment.
 - B. Connect the necessary pumping and piping to convey:
 - 1. Wastewaters from handbasins, toilet facilities, and shower facilities to the designated wastewater storage tanks.
 - 2. Potable water from the potable water tank to facilities requiring running water.
 - C. Perform initial personnel decontamination prior to entering Personnel Hygiene/Decontamination Facility on the decontamination corridor established at each work area. Provide a boot wash, glove wash, refuse containers, and other items required for the initial decontamination of personnel.
 - D. Store wastewater from initial decontamination of personnel separately from wastewaters generated from toilet facilities, handbasins, and shower facilities.
 - E. Sample and analyze containerized wastewater for disposal purposes; submit analytical results to ENGINEER prior to off-Site disposal.
 - F. Provide sufficient sanitary facilities for workers in accordance with governing regulations and ordinances.
 - G. Post notices and take such precautions as required by local health authorities. Maintain Personnel Hygiene/Decontamination Facility and premises in a clean and sanitary condition.
- 1.30 EMERGENCY FIRST-AID FACILITY
- A. Provide, operate, and maintain an Emergency First-aid Facility which complies with the requirements of 29 CFR 1910.141 and contains, as a minimum, the following equipment and supplies:
 - 1. Stretcher.
 - 2. One set of crutches.
 - 3. Two fire extinguishers meeting the requirements of 29 CFR 1910.307.
 - 4. Two self-contained breathing apparatus units including full-face masks.
 - 5. One counter and sink with running potable water connected to the separate sanitary wastewater holding tanks.
 - 6. One cot.
 - 7. Blankets and towels as required.
 - 8. First-aid kit containing medications appropriate for the initial treatment of burns, abrasions, fractures, and ingestion or dermal contact with on-Site hazardous waste.

9. Two hand-held emergency sirens.
10. Two complete sets of Level B personnel protective equipment.
11. Portable emergency eye wash and shower.
12. Locate Emergency First-aid Facility within Personnel Hygiene/Decontamination Facility or separately.

1.31 PORTABLE TOILETS

- A. Provide a minimum of 2 portable sanitary toilets.
- B. Remove and dispose of sanitary wastes off Site on a periodic basis as required and in accordance with applicable Laws and Regulations.
- C. In lieu of portable sanitary toilets, provide toilets housed within Personnel Hygiene/Decontamination Facility which are connected to separate collection tanks or to the existing Site sanitary sewer system.

1.32 STORAGE/STOCKPILING FACILITIES

- A. Construct storage/stockpiling facilities as required. Install liner below all proposed stockpile locations to prevent contact between the stockpile material and the ground. Equip facility with tarps which are capable of covering the stockpiled material until ENGINEER advises CONTRACTOR to dispose of the material off Site.

1.33 WASTEWATER TREATMENT

- A. Design and Operating Criteria:
 1. Design temporary wastewater treatment facilities as specified in Section 02757 capable of treating water generated from dewatering excavations and work areas to meet discharge requirements.
 2. Do not discharge water from Site that is not in compliance with applicable limitations.
 3. Refer to Section 02757 for detailed performance and operating requirements and constraints for wastewater treatment facilities including waters generated from decontamination and other Site facilities.

1.34 WASTEWATER STORAGE TANKS

- A. Provide, operate, and maintain separate wastewater storage tanks to store wastewaters.

B. Wastewater includes:

1. Handbasin, shower, laundry wastewaters from Personnel Hygiene/Decontamination Facility.
2. Water collected from dewatering operations.
3. Water collected from Equipment Decontamination Facility.

C. Store wastewaters from dewatering operations and Equipment Decontamination Facility in a separate tank from the wastewater from Personnel Hygiene/Decontamination Facility.

D. If toilet facilities are provided in Personnel Hygiene/Decontamination Facility, store wastewater from these toilets with the wastewater from the handbasins, and showers for ultimate disposal off Site.

E. Discharges: Comply with applicable discharge limitations and requirements; do not discharge any wastewaters to on-Site sewer systems that do not conform to or are in violation of such limitations or requirements. Obtain ENGINEER's approval prior to discharge of wastewater.

F. Install wastewater storage tanks in locations directed by ENGINEER.

G. Support tank(s) on a temporary aboveground foundation provided by CONTRACTOR.

H. Connect pumps, piping, valves, miscellaneous items, and necessary utilities as required for operation of the facilities. Protect tanks, valves, pumps, piping, and miscellaneous items from freezing.

I. Do not operate Wastewater Storage Facility until inspected by ENGINEER.

J. Treat and dispose of wastewaters as specified in Section 02757.

1.35 DRUMS

A. Storage of Liquid Waste: DOT-approved 55-gallon steel drums, closable lids, complete with labels for marking contents and date filled.

B. Storage of Solid Waste: DOT-approved 55-gallon steel drums, closable lids, complete with labels for marking contents and date filled.

END OF SECTION

SECTION 01600
MATERIAL AND EQUIPMENT

1.1 SECTION INCLUDES

- A. Transportation and handling.
- B. Storage and protection.
- C. Product options.
- D. Substitutions.
- E. Measurement and payment.

1.2 TRANSPORTATION AND HANDLING

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.3 STORAGE AND PROTECTION

- A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible.
- B. Store sensitive products in weathertight, climate-controlled enclosures.
- C. For exterior storage of fabricated products, place on sloped supports, above ground.
- E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of product.
- F. Store loose granular materials on solid flat surfaces in a well drained area. Prevent mixing with foreign matter.
- G. Furnish equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- H. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.
- I. Protect delivered products from contamination or damage.

1.4 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any approved product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications; options or substitutions allowed in accordance with Gc.19 of General Conditions. Submit a request for substitution for any manufacturer not named in accordance with the following article.

1.5 SUBSTITUTIONS

- A. Gc.19 of General Conditions specifies requirements and procedures for submitting requests for substitutions after Notice of Award.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- C. A request for substitution constitutes a representation that CONTRACTOR:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 - 2. Will provide the same warranty for the substitution as for the specified product.
 - 3. Will coordinate installation and make changes to other Works which may be required for Works to be complete at no additional cost to TRUST.
 - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
 - 5. Will reimburse TRUST for review or redesign services associated with re-approval by authorities.
- D. Substitutions will not be considered when they are indicated or implied on Shop Drawings or product data submittals, without separate written request.
- E. Substitution Submittal Procedure after Notice of Award:
 - 1. Submit 3 copies of request for substitution for consideration. Limit each request to one proposed substitution.
 - 2. Submit Shop Drawings, product data, and certified test results and other data as required by Gc.19 of General Conditions attesting to the proposed product equivalence. Burden of proof is on CONTRACTOR.
 - 3. ENGINEER will notify CONTRACTOR in writing of decision to accept or reject request.

4. ENGINEER will be sole judge as to the acceptance or rejection of CONTRACTOR's request.

END OF SECTION

SECTION 01700
CONTRACT CLOSEOUT

1.1 SECTION INCLUDES

- A. Closeout procedures.
- B. Final cleaning.
- C. Adjusting.
- D. Final grading.
- E. Final decontamination.
- F. Final removal.
- G. Off-Site disposal.
- H. Spare parts and maintenance materials and extra materials.
- I. Measurement and payment.

1.2 CLOSEOUT PROCEDURES

- A. Submit written notice to ENGINEER that the entire Works or an agreed portion thereof is complete and ready for ENGINEER's inspection prior to Preliminary Acceptance of Works.
- B. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for ENGINEER's review.
- C. Complete and furnish submittals to ENGINEER that are required by governing or other authorities and by these Contract Documents. Payment shall not become due and payable until all submittals have been made acceptable to ENGINEER.

1.3 FINAL CLEANING

- A. Execute final cleaning prior to Preliminary Acceptance of Works.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces.
- C. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- D. Replace filters of operating equipment.

- E. Clean debris from roofs, gutters, downspouts, and drainage systems.
- F. Clean Site; sweep paved areas, rake clean landscaped surfaces.
- G. Remove surplus materials from Site.
- H. Dispose of non-contaminated litter and rubbish at an off-Site sanitary landfill approved by ENGINEER.

1.4 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

1.5 FINAL GRADING

- A. Perform final grading prior to Preliminary Acceptance of Works. Ensure that no low areas remain which might pond or collect water.

1.6 FINAL DECONTAMINATION

- A. Perform final decontamination of construction facilities, equipment, and materials which may have come in contact with potentially contaminated materials prior to removal from Site.
- B. Perform decontamination as specified in Section 01500 to the satisfaction of ENGINEER. ENGINEER will have right to direct CONTRACTOR to perform additional decontamination if required.
- C. ENGINEER will collect soil samples for chemical analyses from traveling surfaces of constructed and existing access routes upon completion of Works.

1.7 FINAL REMOVAL

- A. Temporary utilities, facilities, and controls:
 - 1. Remove temporary utilities, equipment, facilities, materials, prior to Preliminary Acceptance of Works.
 - 2. Remove underground installations to a minimum depth of 2 feet. Grade Site as indicated.
 - 3. Clean and repair damage caused by installation or use of temporary work.
 - 4. Restore existing facilities used during construction to original and functional condition.
- B. Wastewater: Sample and analyze stored wastewater for disposal purposes prior to removal from Site. The results of the analyses will determine the appropriate methods of disposal. Upon receipt of the analytical results, transfer tank contents to liquid waste tankers. Transfer tank contents without spills or release. Following completion of tank emptying, decontaminate the

tank interior with a steam or high-pressure water wash supplemented by detergent (Alconox).
Dispose of tank decontamination water with tank contents.

- C. Excavate and dispose of soil contaminated (as determined in Paragraph 1.5 C) by CONTRACTOR's activities as directed by ENGINEER, at no cost to TRUST.

1.8 OFF-SITE DISPOSAL

- A. Dispose of the following materials at an appropriate off-Site facility identified by CONTRACTOR and approved by TRUST:

1. Debris including excess construction material, non-contaminated litter and rubbish.
2. Spent Tyvek and other disposable PPE worn during final cleaning.
3. Wastewater removed from wastewater storage tank, wastewater generated from final decontamination operations including wastewater storage tank cleaning.
4. Lumber from the decontamination pads.

- B. Dispose of materials in accordance with Section 02759.

1.9 SPARE PARTS, MAINTENANCE MATERIALS, AND EXTRA MATERIALS

- A. Furnish spare parts, maintenance materials, and extra materials in quantities specified in individual Sections.
- B. Deliver to location on Site as directed by ENGINEER prior to Preliminary Acceptance of Works.

END OF SECTION

SECTION 02018
MONITORING WELLS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Drilling and casing groundwater monitoring well.
- B. Obtaining continuous split-spoon samples from the overburden during borehole advancement.
- C. Development of overburden monitoring wells to a silt-free condition.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 2. A312/A312M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
 - 3. C150 - Standard Specification for Portland Cement.
 - 4. D422 - Standard Test Method for Particle-Size Analysis of Soils.
 - 5. D1586 - Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.
 - 6. D1587 - Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils.
 - 7. D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - 8. D2113 - Standard Practice for Diamond Core Drilling for Site Investigation.
 - 9. D2488 - Standard Practice for Description and Identification of Soils.
- B. Department of Transportation (DOT).

1.3 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Materials: Provide Material Safety Data Sheets as appropriate for any materials brought to Site.

- C. **Samples:** Should the source of any materials to be used downhole change, submit a sample of new material for analyses; such submissions shall be in addition to any submission required to be submitted to other authorities having jurisdiction.
- D. **License:** Proof of Ohio license to perform this work.
- E. **Qualifications:** Resume and proof of certification by State of Ohio.
- F. **Manufacturer's Instructions:** Indicate rigging, assembly, and installation instructions.
- G. **Record Documents:** Accurately record actual locations of well, depth, subsoil strata, and drilling difficulties encountered. Submit a signed copy of driller's log book statements.
- H. **Soil Samples:** Submit samples required by state and local authorities.

1.4 QUALITY ASSURANCE

- A. The monitoring well will be used to measure water level elevations and to obtain representative groundwater samples for chemical analysis.
- B. Because of the nature of activities which have taken place at Site, the monitoring well may penetrate potentially contaminated soil. Take necessary precautionary measures to prevent contamination near ground surface from being carried downhole. When drilling through fine-grained overburden into an underlying aquifer, prevent potential overburden contamination from passing into the isolated aquifers.
- C. Procure permits, certificates, and licenses required by law for the execution of Works. Request and obtain waivers from authorities having jurisdiction and submit to ENGINEER prior to commencement of work at Site. Comply with state, and local Laws and Regulations relating to the performance of Works.

1.5 QUALIFICATIONS

- A. **Drilling Firm:** Company specializing in performing the work of this Section with minimum 5 years documented experience.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. **Section 01500 - Construction Facilities and Temporary Controls:** Requirements for temporary controls.
- B. Shut off and seal a hole should flowing artesian water or gas be encountered.
- C. Take necessary precautions to ensure subsurface soils and water which could impact the integrity of Site are not released.
- D. Remediate any release of potentially contaminated material and restore the area to preconstruction conditions using clean imported materials.

- E. Ensure that drilling methods do not impair production from aquifers encountered.

1.7 SEQUENCING AND SCHEDULING

- A. Section 01015 - General Requirements: Requirements for coordination.
- B. Sequence and schedule work subject to the following conditions:
 - 1. ENGINEER will determine location and sequence of drilling events.
 - 2. Strictly enforce equipment cleaning.
 - 3. Complete drilling and installation activities at each well in its entirety before moving to a subsequent well.

PART 2 PRODUCTS

2.1 RISER

- A. ASTM D1785 Schedule 40, PVC, 2 inch ID.

2.2 SURFACE CASING AND CAP

- A. ASTM A53 Schedule 40, carbon steel, 6 inch ID, with a lockable cap welded to a hinge with the hasp welded directly to the side of the surface cavity. Wrap the exposed exterior surface of casing with reflective tape following installation.
- B. ASTM A53, Lockable cap of same materials as surface casing, 6 inch ID.

2.3 CEMENT

- A. ASTM C150 Type I, Portland cement.
- B. Do not use quick setting cement containing additives.

2.4 WELL SCREEN

- A. ASTM D1785 Schedule 40, PVC, 2 inch ID; 10-foot screen length with 10-slot size or as determined by ENGINEER in field.

2.5 SILICA SAND

- A. Inert uniformly graded (20 to 40 mesh), well rounded and free of fines.
- B. Gradation: Containing no more than 10 percent of sand grains finer than screen slot size.

2.6 BENTONITE GROUT

- A. Mixture of Volclay or Benseal; ratio of 2.1 pounds of bentonite with 1 U.S. gallon of water to yield a minimum density of 9.4 pounds per U.S. gallon.

2.7 CEMENT-BENTONITE GROUT

- A. Mixture of 6.5 U.S. gallons of water per 94-pound bag of cement specified in Article 2.3.
- B. Add approximately 4 pounds of bentonite powder per bag of cement to the slurry.
- C. Quantity of Bentonite: Not exceeding 5 percent by weight of the mixed slurry.

2.8 CONCRETE

- A. Pre-mix concrete mixed to manufacturer's specifications with potable water.
- B. Compressive Strength: Minimum 3,000 psi at 28 days.

2.9 BENTONITE CHIPS

- A. Chipped sodium montmorillonite furnished in sacks or buckets, free of impurities, from a commercial source.
- B. Diameter: Less than 1/5 the width of the annular space into which they are placed.

2.10 BENTONITE PELLET SEAL

- A. Size: 3/8 inch diameter.
- B. Type: As approved by ENGINEER.

2.11 OTHER MATERIALS

- A. Selected by CONTRACTOR for the purpose intended and subject to ENGINEER's approval prior to use.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01015 - General Requirements: Verification of existing conditions before starting work.
- B. Verify that Site conditions will support equipment for performing drilling operations.

C. Do not commence drilling operations until ENGINEER has located and marked the location of each well; proceed with installation of well only upon receipt of written instructions from ENGINEER.

D. Obtain ENGINEER's approval for any material introduced into borehole.

3.2 PREPARATION

A. Protect structures near well from damage.

B. Prior to commencing drilling at each drilling location, protect surface soil in the immediate area of drill rig with 2 layers of minimum 3-mil polyethylene (HDPE) sheeting covered by 5/8-inch plywood; minimum area to be covered: approximately 12 feet by 16 feet; contain drill cuttings on top of the plywood prior to transfer to an on-Site landfill.

C. In addition to HDPE sheeting, surround the work area around the drill rig with absorbent pads to prevent the release of surface water during drilling operations. If absorbent pads are contacted by drilling liquids or surface water contacting material potentially containing Site-specific constituents, place the absorbent pads in drums pending final disposal.

D. Equipment Cleaning:

1. Upon mobilization to Site and prior to commencing drilling, take drill rig and associated equipment to the designated on-Site Equipment Decontamination Facility and thoroughly clean with a high-pressure, low-volume, hot water wash to remove mud and other foreign matter; ensure drill rig and associated equipment are free of mud and hydraulic fluid, seals and gaskets are intact, and no fluids are leaking. Remove loose paint or encrustation from downhole equipment prior to use; remove by sandblasting prior to mobilization to Site.
2. Take downhole equipment used in the completion of soil borings and installation of wells to Equipment Decontamination Facility and clean as specified herein prior to commencing each borehole to prevent cross-contamination from the previous drilling location.
3. Clean drill rig prior to mobilizing to each well location.
4. Clean well screens and casings prior to installation as specified herein.
5. Equipment cleaning as specified herein is in addition to requirements of Section 01500.

E. Methods of Cleaning:

1. Clean downhole drilling equipment such as augers, cutting bits, drill steel, and associated equipment and tools that will contact potentially contaminated soil or groundwater with clean, hot water under high pressure using the following wash sequence:

1. Wash and wipe dry.
2. Rinse.

2. Clean screens and casings thoroughly using the following wash sequence:
 1. Sand off printing inks, if present, on the surface of casing or screen.
 2. Wash equipment thoroughly with a detergent (Alconox) high-pressure wash to remove particulate matter or surface film (if any).
 3. Rinse with deionized water.
3. Clean sampling equipment and tools thoroughly, including split spoons or other equipment used for collecting soil samples during construction of wells, using the following rinse sequence:
 1. Clean with potable water and detergent (Alconox) using a brush if necessary to remove particulate matter and surface films.
 2. Rinse thoroughly with potable water.
 3. Rinse thoroughly with deionized water.
 4. Wrap with aluminum foil to prevent contamination if equipment is going to be stored or transported.
4. Wash steel tapes, electric probes, transducers, and other water level measuring and displacement devices that are lowered into monitoring wells below the water surface, with clean water and detergent, rinse with isopropanol and deionized water, then wipe dry with a clean paper towel after removing from one well and before lowering into another well.

3.3 OVERBURDEN MONITORING WELL CONSTRUCTION

- A. Use drilling equipment and methods approved by ENGINEER.
- B. Drill concentric well shaft to diameters and depths indicated in locations shown on Drawings.
- C. Advance borehole using 6 1/4-inch ID, hollow-stem augers (HSA) to ensure a minimum 10-inch diameter borehole. Collect continuous soil samples for the entire depth of borehole using 2-inch diameter split-spoon samplers in accordance with ASTM D1586 or other methods approved by ENGINEER. Advance borehole to a depth no greater than 30 feet as directed by ENGINEER in field.
- D. Define hollow-stem auger refusal as 50 counts per 6-inch auger advancement with 140-pound hammer. If auger refusal is encountered, ENGINEER will mark the relocation of the overburden monitoring well.
- E. Construct each well in accordance with the details shown on Drawings.
- F. Clean shaft bottom of loose material.
- G. Place well casing immediately after drilling. Set firmly in place.
- H. Allow inspection of casing by ENGINEER prior to placing grout.

- I. Place grout tight to surrounding work in accordance with regulatory requirements.
- J. Maintain well opening and casing free of contaminating materials.
- K. Cut off shaft top 24 inches above grade. Do not permit metal cuttings to enter casing.
- L. Attach monitoring well screen to monitoring well riser pipe by threaded flush joint couplers and lower through hollow-stem augers to the desired screened interval, as directed by ENGINEER. Take precautions to prevent damage to threaded joints during installation.
- M. Provide ballast to well screen and riser pipe assembly as it is lowered into borehole to the determined level and held into position. Ballasting may be accomplished by continuously filling riser pipe with non-contaminated water from a source of known chemistry. Alternatively, well screen and riser pipe assembly may be slowly pushed into the fluid in borehole with the aid of hydraulic rams on the drill rig and held in place as additional sections of riser pipe are added to the column.
- N. Extend riser pipe above grade and cap temporarily to deter entrance of foreign materials during overburden monitoring well completion.
- O. Place suitably graded silica sand in the annulus between augers and riser pipe by using a decontaminated, flush-threaded, 3/4-inch diameter tremie pipe as augers are withdrawn from borehole to a height of 2 vertical feet above the top of screen.
- P. If bridging of the silica sand occurs, mechanically break the bridged material prior to proceeding with the addition of more silica sand.
- Q. Install a bentonite pellet seal measuring a minimum of 2 vertical feet above the silica sand using a 3/4-inch specified tremie pipe to ensure that a good seal is formed. Lower the tremie pipe to the top of the filter pack and slowly raise as the bentonite pellets fill the annular space.
- R. Allow sufficient time for the bentonite pellet seal to hydrate or the slurry annular seal to expand prior to grouting the remaining annulus.
- S. Center a protective surface casing over the riser and extend into the concrete a minimum of 2 feet and stickup above ground 2.5 feet.
- T. Fill the remainder of borehole with bentonite cement by the tremie method or other approved method until undiluted grout returns to ground surface. Place grout in one continuous operation with the entire amount placed before initial set occurs. Remove the uppermost 2 feet of bentonite grout and replace with concrete.
- U. Weld a locking cap mechanism to the protective casing.
- V. Screens:
 - 1. Clean monitoring well screens prior to installation in accordance with Paragraph 3.2 E.
 - 2. Install well screens by methods approved by ENGINEER and in accordance with manufacturer's recommendations.

W. Riser Pipe:

1. Clean riser pipe and fittings prior to installation in accordance with Paragraph 3.2 E.
2. Install riser pipe to sizes and depths shown on Drawings and in locations designated by ENGINEER. Provide a nominal riser pipe stickup above ground of 2.5 feet.
3. Maintain accurate records of riser pipe lengths and sizes installed.

X. Protective Surface Casing:

1. Clean protective surface casing and fittings prior to installation in accordance with Paragraph 3.2 E.
2. Install casing to sizes and depths shown on Drawings and in locations designated by ENGINEER. Provide a nominal casing stickup above ground of 2.5 feet.
3. Maintain accurate records of riser pipe lengths and sizes installed.

Y. Concrete:

1. Use concrete to backfill the uppermost 2 feet of monitoring well and to form a 2-foot by 2-foot by 2-foot thick concrete collar flush with ground surface around the protective casing at ground surface. Construct concrete to promote surface drainage away from well.
2. Mix and place concrete by hand in 1 continuous operation with the entire amount poured before initial set occurs.

3.4 ROTOSONIC DRILLING

- A. CONTRACTOR may choose to install upper aquifer monitoring wells using rotosonic drilling methods. At a minimum, advance a 6-inch diameter borehole for upper aquifer monitoring wells. Should CONTRACTOR choose to use rotosonic drilling methods, submit proposed well installation methods to ENGINEER, at least 14 days prior to commencing installation of upper aquifer wells.

3.5 BOREHOLE LOGGING

- A. Maintain a log or record of each borehole using ASTM D1586 and D2488 methodology on a form approved by ENGINEER. Include, at a minimum, the following information:
1. The reference point for depth measurements.
 2. The general character, thickness, and type of material encountered.
 3. Stratigraphic changes noting strata thickness, lithology including size, range, and shape of constituent particles, rock type, and rate of penetration.
 4. The depth interval from which soil sample was taken.

5. The depth at which the water level stands in well at the beginning and end of each shift.
6. The depth of borehole.
7. The nature and extent of other work performed, including the exact time spent on each item of work.

- B. Keep the log carefully and accurately at the time the work is being done. Maintain a copy of the log at all times at Site and make available for inspection at any time by ENGINEER. Upon completion of Works furnish a complete copy to ENGINEER, and file, as required by the well construction permit, the necessary log and record of forms required by the approving authority.

3.6 WELL DEVELOPMENT

- A. Clean and develop overburden monitoring wells after completion following a 24-hour period to allow cement-bentonite grout to set.
- B. Clean equipment used during well development prior to use in each overburden monitoring well as specified.
- C. Provide ENGINEER with the method proposed for well development and await written approval of this method before commencing well development. Preferred development methods include bailing and surge blocks. If airlift methods are to be used, use Norgren Type F47 and Type F18 filters.
- D. Continue well development until representative water, free of drilling fluids, cuttings, or other materials introduced during well installation is obtained or as directed by ENGINEER.

3.7 PROTECTION OF COMPLETED WELL

- A. Protect monitoring well by a protective surface casing complete with lockable cap or with a flush-mounted lockable cap. Vent protective casing by drilling 4 weep holes in the base of casing immediately above the concrete surface pad to facilitate drainage of water which may collect in casing. Place dry bentonite pellets, granular, or chips in the annular space below ground level within protective casing. Place coarse sand and/or aggregate above bentonite and above weep hole to prevent entry of insects. Install locking caps immediately upon completion of well to prevent access by unauthorized persons. ENGINEER will install locks for securement on protective caps.
- B. Protect monitoring well by concrete-filled steel pipe bollards, minimum 4 inch diameter. Install 4 bollards to surround well as shown on Drawings. Paint bollards yellow.

3.8 WASTE HANDLING

- A. Collect cuttings and solid waste generated during equipment cleaning, well construction, and well development, and place in on-Site landfill.
- B. Collect liquid wastes generated during equipment cleaning, well construction, and well development, and transfer to wastewater treatment system.

3.9 PROTECTION OF FINISHED WORK

- A. Protect completed wells and wells under construction from contamination and damage.**

3.10 SURVEYING

- A. Upon completion of construction of monitoring wells, survey locations of wells using a land surveyor licensed in the State of Ohio. The wells shall be located in both horizontal and vertical planes to the nearest 0.01 foot relative to the National Geodetic Datum and State Plane Coordinate System.**

END OF SECTION

SECTION 02050

DEMOLITION AND REMOVALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Demolition of concrete block structure, building foundation, slabs on grade, equipment decontamination pads, miscellaneous piping, tanks, and placement of demolition debris and other Site debris in landfill.
- B. Restoration of areas disturbed by demolition and removals.

1.2 RELATED SECTIONS

- A. Section 02100 - Site Preparation: Clearing outside periphery of structures.

1.3 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. DOT Regulation: 49 CFR Parts 171 to 179.
- C. OSHA Regulation: 29 CFR Parts 1910 and 1926.
- D. USEPA Regulation: 40 CFR Part 261.

1.4 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Drawings and Plans: Indicate demolition and removal sequence and location of salvageable items; location and construction of barricades, fences, and temporary work.
- C. Record Documents: Accurately record locations of capped utilities, subsurface obstructions, invert and base elevations, and limits of excavations.

1.5 QUALIFICATIONS

- A. Demolition Firm: Company specializing in performing work of this Section with minimum 5 years experience.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable code for demolition of structures, safety of adjacent structures, dust control, runoff control, and disposal.
- B. Obtain required permits from authorities.
- C. Notify utility companies affected and adjacent industries potentially affected before starting work and comply with their requirements.
- D. Do not close or obstruct roadways and fire hydrants without permits and necessary approvals.
- E. Conform to procedures applicable when hazardous or contaminated materials are discovered.
- F. Test confirmatory soil samples collected from around buried foundations and tanks for contamination in accordance with Section 02750.

1.7 SEQUENCING AND SCHEDULING

- A. Section 01015 - General Requirements: Requirements for coordination.
- B. Sequence activities to complete demolition in following order:
 - 1. Demolish building, foundation, concrete pads, sidewalks and other items and place all Site debris in landfill prior to capping of landfill.
 - 2. Permit collection of confirmatory soil samples by ENGINEER. Analyze samples in accordance with Section 02750.
 - 3. Obtain approval of ENGINEER prior to backfilling.
 - 4. Complete area rehabilitation and obtain approval of ENGINEER prior to removal of any drainage diversion structures, sheet piles, or sewers.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 01500 - Construction Facilities and Temporary Controls: Requirements for temporary controls.
- B. Protect fencing, benchmarks, pavement, utility lines, Site appurtenances, trees, root systems of trees, shrubs, plants, and other features not required or specified to be removed.
- C. Prevent movement, settlement, or damage of adjacent areas, structures, services, utilities, adjacent grades to remain, or any other item not specified to be demolished.
- D. Do not block surface drainage systems and mechanical and electrical systems which must remain in operation with debris.
- E. Maintain unobstructed access to fire hydrants and other fire department connections.

- F. Prevent accidental fires and fire damage and take fire protection measures necessary to meet requirements of authority having jurisdiction.
- G. Where practicable, provide access routes within Site for fire department vehicles.
- H. Where demolition Site is fenced so as to prevent general entry, provide for access for fire department equipment and personnel.
- I. Install portable fire extinguishers and maintain in conformance with local fire code. In addition to requirements of local codes, provide appropriate portable fire extinguishers adjacent to cutting or welding operations, in areas where combustibles are stored near or on any internal-combustion engines, adjacent to areas where flammable liquids or gases are stored or handled, and adjacent to temporary oil- or gas-fired equipment.
- J. Perform cutting and welding in conformance with fire codes. Maintain supervision of areas on demolition Site where cutting and welding operations have taken place for at least 1 hour after operations have been completed.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Fill Material: As specified in Section 02205.
- B. Aggregate Material: As specified in Section 02207.
- C. Seeding: As specified in Section 02936.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01015 - General Requirements: Verification of existing conditions before starting work.

3.2 PREPARATION

- A. Provide, erect, and maintain temporary barriers and security devices.
- B. Protect existing landscaping materials, appurtenances, and structures which are not to be demolished.
- C. Prevent movement or settlement of adjacent structures. Provide bracing and shoring.
- D. Mark location of utilities.
- E. Conduct demolition to minimize interference with adjacent structures, trees, or vegetation.
- F. Cease operations immediately if adjacent structures appear to be in danger. Notify ENGINEER. Do not resume operations until danger has been resolved.

- G. Conduct operations with minimum interference to public or private accesses. Maintain egress and access.
- H. Sprinkle work areas with water to minimize dust. Provide hoses and water connections for this purpose.
- I. Remove soil and other foreign materials from surfaces of items to be demolished prior to demolition. Treat removed soil and materials as potentially contaminated and handle accordingly.
- J. Do not commence demolition work until required surface water diversions are in place and approved by ENGINEER.

3.3 RESTORATION OF DISTURBED AREAS

- A. Backfill and compact excavations and areas disturbed by demolition operations with fill (Type S3) obtained from on-Site stockpile.
- B. Place fill to lines and grades shown on Drawings.
- C. Place topsoil and seed disturbed areas as specified in Section 02936.

3.4 INSPECTION

- A. Do not allow or cause any of work performed or installed to be covered up or enclosed by work of this Section prior to required inspections, measurements, tests, or approvals.

END OF SECTION

SECTION 02100
SITE PREPARATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Removal and temporary stockpiling of surface debris.
- B. Clearing and grubbing trees, hedges, weeds, debris, stumps, and vegetation in designated work areas.
- C. Mobilization of wastewater treatment plant.
- D. Lagoon berm construction and upgrading of existing berm system.
- E. Preparation of stabilization area for equipment.

1.2 RELATED SECTIONS

- A. Section 02222 - Excavating.
- B. Section 02240 - Sludge Stabilization and Removal.
- C. Section 02276 - Temporary Erosion and Sediment Control.
- D. Section 02757 - Wastewater Treatment.

1.3 DEFINITIONS

- A. Clearing: Felling, trimming, and cutting of trees into sections and the satisfactory disposal of trees and other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring in the areas to be cleared.
- B. Grubbing: Removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas.

1.4 REGULATORY REQUIREMENTS

- A. Coordinate clearing work with utility companies.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Section 01500 - Construction Facilities and Temporary Controls: Requirements for temporary controls.

- B. Control the amount of dust resulting from clearing and grubbing operations to avoid creation of a nuisance in the surrounding area.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01015 - General Requirements: Verification of existing conditions before starting work.
- B. Verify that existing plant life or other surface features designated to remain are tagged or identified.
- C. Identify staging area for placing removed materials.

3.2 PREPARATION

- A. Protect trees, plant growth, and surface features designated to remain from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as circumstances require.

3.3 CLEARING AND GRUBBING

- A. Clear areas required for access to Site and execution of Works.
- B. Cut off trees, stumps, roots, brush, and other vegetation in areas to be cleared, flush with or below the original ground surface, except such trees and vegetation as shown on Drawings or directed by ENGINEER to be left standing.
- C. Remove trees and shrubs.
- D. Provide temporary erosion and sediment control measurements.
- E. When directed by ENGINEER, remove trees and stumps that are designated as trees from areas outside those areas designated for clearing and grubbing; fell such trees, remove their stumps and roots, and dispose of the trees.
- F. Clear undergrowth and deadwood, without disturbing subsoil.
- G. Remove material to be grubbed, together with logs and other organic or metallic debris not suitable for reuse.
- H. Fill depressions made by grubbing with suitable material to make the surface conform with the original adjacent surface of the ground.
- I. Remove debris, rock, and extracted plant life.

- J. Dispose of trees, logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations in the on-Site landfill as directed by ENGINEER.

3.4 LAGOON BERM CONSTRUCTION AND UPGRADING EXISTING BERM

- A. Raise and upgrade existing earth berms between Lagoons 1 North and 1 South and Lagoon 6, as required. Upgraded berms shall be constructed using methods and materials as deemed appropriate by CONTRACTOR, but shall be capable of supporting the maximum hydrostatic loads imposed by the sludge during the sludge removal process. Lagoon berm construction and upgrading details shall be included in CONTRACTOR's Detailed Stabilization Plan.

END OF SECTION

SECTION 02105

CHEMICAL SAMPLING AND ANALYSIS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Opening, sampling, and resealing of excavated drums and containers staged on drum staging area.
- B. Treatability testing of collected samples.

1.2 RELATED SECTIONS

- A. Section 02126 - Drum/Container Removal.

1.3 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. United States Federal Government - Code of Federal Regulations (CFR):
 - 1. 40 CFR 261 - Identification and Listing of Hazardous Waste.
 - 2. 40 CFR 761 - Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions.
- C. United States Environmental Protection Agency (USEPA):
 - 1. EPA 600/2-80-076 - A Method for Determining the Compatibility of Hazardous Wastes.
 - 2. SW-846 - Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.

1.4 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Drum Log and Waste Analyses Data Sheets: Submit, on a daily basis, drum and container log data sheets for wastes sampled the previous work day. Submit copies of waste, fingerprint, compatibility and/or treatability test data sheets to ENGINEER within 24 hours of receiving data from laboratory.
- C. Quality Assurance Submittals: During performance of Works, submit all submissions listed in CONTRACTOR's Analytical Quality Assurance Project Plan.
- D. Compositing of Samples: Submit for review and approval a list of samples to be composited for characterization at least 3 days prior to the intention to composite samples.

- E. Stabilization Recommendation: Submit for review and approval a plan describing the proposed stabilization approach for drummed/ containerized waste based on bench scale testing. All drums containing materials compatible with Site sludges shall be mixed and stabilized with Site sludge.

For non-compatible drummed waste, submit a proposal for disposal of drummed/containerized waste within 7 days after notification from ENGINEER requesting such a proposal. ENGINEER will review and comment on proposal within 14 days. Address ENGINEER's comments and resubmit proposal within 7 days. The proposal for drummed waste disposal shall be in accordance with the requirements of Section 02759.

1.5 QUALITY ASSURANCE

- A. Perform work of this Section in accordance with CONTRACTOR's Analytical Quality Assurance Project Plan as approved by ENGINEER.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Material and Equipment: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver and ensure a sufficient supply of sample jars and sampling equipment at Site prior to scheduled sampling activities.
- C. Deliver sampling jars and sampling equipment to Site and store in CONTRACTOR's office in an area free from contamination. Store sample jars and equipment in an area which is protected from the environment and is free from contaminated materials or substances.

PART 2 PRODUCTS

2.1 SAMPLING EQUIPMENT

- A. Drum and Container Sampling: Materials and equipment required, as a minimum:
 - 1. Sample containers in accordance with CONTRACTOR's Analytical Quality Assurance Control Plan.
 - 2. Uniquely numbered sample identification label affixed to sample container.
 - 3. Glass sampling thieves.
 - 4. Stainless steel trowel, spoon, or trier for collection of solid or sludge samples.
 - 5. Remotely operated non-sparking pneumatic ram or check key device.
 - 6. Brass mallet and chisel.
 - 7. Bung wrench.

8. Ground cable and rod.

PART 3 EXECUTION

3.1 PREPARATION

- A. Have the required health and safety and sampling equipment necessary to perform sampling prior to commencing opening and sampling activities.

3.2 WASTE SAMPLING

- A. Conduct sampling and analysis in accordance with CONTRACTOR's Analytical Quality Assurance Project Plan.
- B. Conduct waste fingerprint, compatibility, and treatability sampling and analysis on drummed and containerized wastes located in drum staging area. As a minimum, collect 1 sample from each excavated drum or container for each phase present.
- C. After sample collection, place sample jars in their original shipping box clearly labeled on the outside with assigned sample numbers of samples contained. Store samples at required temperature in a secured area which is protected from exposure to the environment or other detrimental damage. Supply heat as necessary to prevent possible freezing.
- E. Presampling Safety Considerations:
 1. Exercise extreme care when opening drums or other sealed containers whose contents may be harmful to sampling personnel. When practical, do not remove or open a drum or container unless it appears to be structurally sound. Move drums/containers by remote means as much as is practical and in seclusion from each other.
 2. Examine drums and containers for markings, bulging, corrosion, or other weakness, to identify materials or conditions which may pose a hazard to sampler. Open drums and containers in such a manner that excess interior pressure, as evidenced by bulging or swelling, can be safely relieved. In all cases, open the lid or bung slowly to allow for release of pressure.
 3. During initial inspection, clearly mark customized containers, suspicious looking drums, or drums labeled as containing hazardous materials (e.g., explosives) for special handling.
- F. Drum and Container Entry:
 1. Ground the drum/container prior to sampling. Drive a metal grounding rod into the ground adjacent to drum staging area. Clip a wire, leading from the rod, to the drum/container prior to opening the drum/container.
 2. Open the drum/container by removing the bung. Enter a drum/container that has a badly rusted bung, or that cannot be opened as above, with a non-sparking penetrating device operated remotely (e.g., brass rod attached to backhoe arm). Plug openings following sampling operations.

G. Sampling Procedures:

1. Sampling of Drummed/Containerized Liquid Waste:

1. Remove cover from sample container.
2. Slowly insert a sampling thief almost to the bottom of the drum/container or until a solid layer is encountered. Approximately 1 foot of tubing should extend above the top of the drum/container.
3. Allow waste in the drum/container to reach its natural level in the tube.
4. Cap the top of sampling tube with a double-gloved thumb or stopper, ensuring liquids do not come into contact with sampler's thumb or stopper.
5. Carefully remove the capped tube from the drum/container.
6. If more than 1 phase of material is identified, sample each phase separately from mid-phase for compatibility testing, waste characterization, and waste profiling, as appropriate. If no phasing is apparent, collect sample from the entire depth of waste.
7. Insert the uncapped end in sample container, do not spill liquid on outside of bottle.
8. Release the thumb or stopper and slowly allow the glass thief to drain and fill the sample container. Repeat the above steps until sufficient volume has been collected for analysis.
9. Remove the tube from sample container, break, and place the tube in the drum.
10. Cap the sample container tightly and place prelabeled sample container in a carrier.
11. Replace the bung or otherwise seal the drum/container. Replace the bung on overpack drum (if applicable).
12. Change disposable gloves used as outer gloves during sampling between each sample.
13. Fill out Field Sampling Data Sheet and Chain-of-Custody Sheet.
14. Transport sample to laboratory for analysis employing chain-of-custody procedures specified in this Section.

2. Sampling of Drummed/Containerized Solids or Sludges: In general, conform to the preceding procedures but with the following exceptions:

1. Collect sample using a stainless steel trowel, spoon, or trier.
2. Collect sample from a depth at least 12 inches from the top of drum/container contents, if practical.

3. Comprise sample of a composite of a minimum of four 25 gram samples, collected from representative locations throughout the drummed/bulked solids or sludges.
4. Open and sample the excavated drum/container in drum staging area within 24 hours of arrival of the drum/container in drum staging area.
3. Once sampled, segregate drums/containers as liquid or solid, or unstable/dangerous then place accordingly in drum staging area. Place in double rows, with at least 6 feet between any adjacent row. Staging requirements for dangerous materials will be assessed by ENGINEER and CONTRACTOR's Health and Safety Officer.

3.3 SAMPLING AND EQUIPMENT CLEANSING

- A. Clean reusable sampling equipment between sampling events using the following rinse sequence:
 1. Scrub with detergent (Alconox) and clean water rinse to remove visible foreign matter.
 2. Rinse with pesticide-grade isopropanol.
 3. Rinse with deionized water.
 4. Air dry for 15 minutes.
 5. Repeat steps 2, 3, and 4.
- B. Following the final rinse, visually inspect sampling equipment to verify that it is free of particulates and other solid material which may contribute to possible sample cross-contamination. Do not recycle fluids used for cleaning. Collect washwater, rinse water, and decontamination fluids and transfer to drums pending final disposal in accordance with Section 01500.

3.4 SAMPLE SHIPMENT

- A. Pack samples in coolers with appropriate cushioning material in accordance with CONTRACTOR's Analytical Quality Assurance Project Plan. Ship samples to be analyzed off Site daily to project laboratories by overnight courier or deliver directly by sampling personnel. Ensure sample shipment conforms to 49 CFR § 172.101 DOT regulations for shipping high hazard samples.
- B. Seal each cooler with 2 transportation security seals containing sampler's initials. Seal cooler with packing tape.

3.5 CHAIN-OF-CUSTODY

- A. Maintain control and responsibility of samples at all times. Keep samples under the control of CONTRACTOR's sampling personnel in the field until relinquished to laboratory. Complete chain-of-custody documents for each cooler and enclose the original and 2 copies within the cooler. In addition, maintain Field Sampling Data Sheets and a sample log of samples collected and shipped off Site. Provide copies of daily logs, Field Sampling Data Sheet, and completed

chain-of-custody document to ENGINEER on a daily basis. The chain-of-custody document consists of 4 carbon copies. Retain 1 for CONTRACTOR's sampler, 1 to ENGINEER, 1 to analytical laboratory, and the original to be returned by analytical laboratory to CONTRACTOR with analytical results.

- B. A typical chain-of-custody form used during sample transport is presented in Attachment C. Alternate forms provided by laboratory or CONTRACTOR may be approved for use by ENGINEER provided the form is functionally equivalent. Upon receipt of samples at laboratory, inspect the cooler and the seal for signs of tampering by the designated sample custodian. The condition of the cooler and seal shall be noted on the chain-of-custody form by the sample custodian and the chain-of-custody form shall be signed by the sample custodian.
- C. Laboratory shall employ chain-of-custody procedures throughout the handling of samples in laboratory from the time of receipt to completion of analysis. Completed chain-of-custody forms, describing transport to and receipt at laboratory, are required to be returned to CONTRACTOR's Quality Control Manager with the hard copy of the analytical report. Testament to proper chain-of-custody handling procedures employed in laboratory shall be supplied by laboratory upon request.

3.6 WASTE FINGERPRINT TESTING

A. Waste Fingerprint and Identification:

- 1. Segregate drummed and containerized wastes and tank contents according to waste class prior to compatibility testing and consolidation, and subsequent waste characterization for disposal. The waste classes determined will permit an assessment of material incompatibilities and chemical characteristics which need to be further addressed for disposal purposes. Subject segregated materials which are determined to have the same fingerprint characteristics as determined by the waste class, to compatibility testing prior to consolidation, if any, for disposal. Properly characterize (analyze) wastes in accordance with USEPA and OEPA approved operating procedures.
- 2. Fingerprint waste to determine, as a minimum, the following characteristics:
 - 1. Phase (liquid or solid).
 - 2. Ignitability.
 - 3. Water reactivity.
 - 4. Water solubility.
 - 5. Oxidizer.
 - 6. Peroxide.
 - 7. pH.
 - 8. Presence of nitric/perchloric acid.
 - 9. Sulfide.

10. Cyanide.
 11. Presence of halogens.
 12. Flammability.
3. Submit a report to ENGINEER identifying waste class(es) applicable to each container and proposed combinations for compatibility testing and consolidation, as applicable.

3.7 WASTE COMPATIBILITY AND TREATABILITY TESTING

- A. Conduct compatibility testing with Site sludge as approved by ENGINEER.
- B. Where waste materials with different waste classes or with different compatibility characteristics are considered for consolidation, use the information obtained from tests in conjunction with the compatibility information contained in USEPA document for assessing the potential for incompatible reactions.
- C. Perform compatibility testing for the purpose of stabilization in a laboratory using small quantities of the materials proposed for consolidation. Conduct compatibility testing for binary combinations by adding 1 component to the other and monitoring for resultant physical reactions that occur. The materials are incompatible when reaction consequences include any of the following:
 1. Heat generated by chemical reaction.
 2. Fire produced by extremely exothermic reactions.
 3. Generation of innocuous gases (i.e., N_2 , CO_2) which can cause pressurization of closed containers potentially resulting in container rupture.
 4. Generation of toxic gases (i.e., HCN , H_2S).
 5. Generation of flammable gases (i.e., H_2 , C_2H_2).
 6. Explosion due to extremely vigorous reactions or reactions producing sufficient heat to detonate unstable reactions or reaction products.
 7. Violent polymerization resulting in generation of extreme heat and sometimes toxic/flammable gases.
 8. Solubilization of toxic substances.
- D. Do not attempt compatibility testing of ternary combinations unless 2 of the materials have already been binary tested and the resulting compatible product is used for testing.

3.8 SAMPLE MAINTENANCE, STORAGE, AND DISPOSAL

- A. Maintain and store samples on Site in an air conditioned/heated trailer kept at standard temperature until the waste which the sample represents has been disposed of at an off-Site facility. Return samples submitted to off-Site laboratories to Site and similarly store. Prior to disposing of samples, notify ENGINEER in writing and proceed only upon written approval of ENGINEER.

END OF SECTION

SECTION 02126
DRUM/CONTAINER REMOVAL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Construction of Drum Staging Area.
- B. Removing drums/containers from Lagoon sludges.
- C. Overpacking drums/containers, if necessary.
- D. Loading drums/containers on haulage units and transporting to drum staging area.

1.2 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. American Society for Testing and Materials (ASTM): D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- C. United States Federal Government - Code of Federal Regulations (CFR):
 - 1. 40 CFR 261 - Identification and Listing of Hazardous Waste.
 - 2. 29 CFR 1910 - Occupational Safety and Health Standards.
 - 3. 29 CFR 1926 - Safety and Health Regulations for Construction.
- D. Occupational Safety and Health Administration (OSHA).

1.3 DEFINITIONS

- A. Drum/Container: Drum or container of any size made of metal, plastic, fiber, or other material which has in the past, is presently, or has been designed to contain a liquid, solid, or sludge.
- B. SMDD: Standard Maximum Dry Density and in the context of this Contract means the maximum dry unit weight determined in accordance with ASTM D698.

1.4 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Drum/Container Removal Plan: Within 15 days after the date of Notice to Proceed, submit Drum/Container Removal Plan. Describe equipment and procedures to excavate and remove drums. Address specific topics including:

1. Description of work teams and the function of members of work teams involved in drum/container excavation and removal.
2. Air monitoring during drum/container excavation and removal.
3. Equipment used during drum/container excavation and removal, with particular reference to how the equipment will limit damage to drums/containers and limit sparking.
4. Procedures to control and contain spilled liquids if a leaking drum is encountered.
5. Procedures if an unusual or bulging drum/container is encountered.
6. Procedures to remove drums/containers from excavations and place if necessary in overpack drums.
7. Equipment to transport drums/containers to drum staging area.

1.5 SEQUENCING AND SCHEDULING

- A. Section 01015 - General Requirements: Requirements for coordination.
- B. Sequence work to conform with approved Landfill Construction and Stabilization Plans and amendments.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Overpack Drums: 85-gallon DOT-approved drums. May be reused if cleaned to remove gross contamination.
- B. Polyethylene Sheeting: Continuous sheeting fabricated from a single ply of construction grade polyethylene plastic Griffolyn TX-120, 10-mil nylon reinforced material.
- C. Other Materials: Selected by CONTRACTOR for the purpose intended and subject to ENGINEER's approval prior to use.

PART 3 EXECUTION

3.1 PREPARATION

- A. Remove obstructions from surfaces where drums shall be removed, within the limits shown on Drawings, or as required to construct the finished work.
- B. Define work areas where excavation and associated activities are being carried out which disturb or require potential contact with buried drums/containers as Exclusion Zone as specified in Section 01111. Classify an area as Exclusion Zone until backfilled. Vehicles, equipment, and

personnel shall enter and exit Exclusion Zone only through Contaminant Reduction Zone as specified in Section 01111.

C. Construct Drum Staging Area as shown on Drawings.

3.2 EXCAVATING

A Equipment Requirements:

1. Remove or cover teeth on backhoe or front-end loaders used to remove drums or containers.
2. To reduce the potential for sparks, line metal parts of drum/container handling equipment which will potentially contact drums/containers.
3. Use direct powered equipment for handling and transport of drums/containers and regularly maintain them to prevent the generation of sparks or backfiring.
4. Operator shields shall be provided on all equipment used to remove, transport or handle drums.

B. Excavate and remove any drums/containers of any size or condition which are encountered, including contents.:

C. Excavated surface will be visually inspected by ENGINEER for buried drums/containers.

D. Remove any visible drums/containers and/or debris immediately associated with drums/containers.

E. Complete removals in accordance with OSHA trenching requirements, 29 CFR 1926.

F. Conduct excavations systematically unless otherwise directed by ENGINEER.

G. Develop sequencing of the removal such that damage to drums/containers and spillage of contents is prevented.

3.3 DRUMMED AND CONTAINERIZED WASTE HANDLING

A. As a minimum, comply with OSHA 29 CFR 1910.120 - Hazardous Waste Operations and Emergency Response, Section (j), when drummed and/or containerized wastes are encountered during excavation.

B. Excavate and handle wastes using methods and equipment specifically designed to minimize leakage or spillage to the maximum extent made possible by the condition of drum and/or container.

C. Equipment Requirements:

1. Use mechanical equipment whenever possible for handling, moving, and transporting drums/containers, unless it is for installation of slings.

2. Move drums/containers by grappler, or if necessary with non-ferrous slings, within a backhoe bucket, front-end loader, or by other means that will prevent damage to drums/containers and release of contents therefrom.
3. Movement or handling by personnel may be required in the event that mechanical means cannot be properly or safely employed due to drum/container breakage or leakage.
4. Construct portions of equipment that contact drums/containers of non-ferrous metals. Coat or line steel construction to preclude spark generation in accordance with 29 CFR 1910.120(j)(3). Use intrinsically safe portable pumps.
5. Equip handling and transport equipment with Class ABC fire extinguishers complying with 29 CFR 1910.157, and air-supplied respirator with 5-minute escape bottles if deemed necessary by Health and Safety Officer.
6. Regularly maintain and repair diesel powered equipment used for handling and transport of drums/containers.
7. Keep a maintenance sheet for equipment used on Site, completed as required and made available to ENGINEER upon request.
8. Maintain ignition, manifold, and exhaust components to prevent backfiring or generation of sparks within exhaust gases.

D. Drum/Container Excavation and Handling:

1. During excavation and handling of drums/containers, designate a team of personnel specifically trained in handling drummed or containerized waste.
2. Comprise the team of no fewer than 2 drum handling personnel and supervisor.
3. Maintain visible contact among members of the working team at all times.
4. Maintain communication between team members. If direct communication between crew members is not possible or effective for whatever reason, transmit communications via intrinsically safe 2-way radios (during activities requiring SCBA) or verbal (during other activities) in accordance with 29 CFR 1910.120(j)(5)(iv) with the exception of heavy equipment operations. Maintain radio communication between heavy equipment operators and the supervisor.
5. As drummed or containerized waste is encountered and prior to physically handling drums or containers, complete a preliminary classification checklist including:
 1. Screening of drum or container with an explosimeter.
 2. An organic vapor detector for organic vapors.
 3. A visual description of drum or container, contents, labeling information (if available and legible).
 4. Condition of drum or container as it appears in the excavation.

6. If during this inspection an open or leaking drum or container is identified to contain liquids, pump or bail the liquids into an appropriate sized repack drum prior to removing drum or container from the excavation.
7. Remove drums/containers from the excavation and stage next to the excavation on a flat working area free of debris or objects that would interfere with safe handling of drums/containers.
8. Overpack drums/containers prior to removal and transportation to drum staging area if drum/container is severely damaged, corroded, or leaking.
9. Seal overpacked and repacked drums when filled.
10. Using a paint stick, mark container or drum or overpack drum (if overpacked) to indicate drum number. Number the top and 2 opposing sides of drum. Use the number form ____-XXXX, where XXXX refers to the unique drum/container number, starting at 0001.

E. Drum Staging and Handling:

1. Remove drums and containers from the lagoons and transfer to drum staging area by flat bed truck, forklift, or other means approved by ENGINEER.
2. Secure drums during transport such that they remain upright and do not move from their position.
3. Place drums on CONTRACTOR-supplied pallets within drum staging area and orient in double rows 6 feet apart to permit sampling of each individual drum for fingerprinting, compatibility, characterization, and treatment parameters.
4. Provide sufficient area to permit forklift and truck access to drums and maintain at all times.

F. Spill Prevention and Response:

1. Conduct handling and transport of drummed or containerized waste in a controlled and safe manner which will minimize damage to containers, containerized materials, and the environment.
2. Spill control measures shall comply with the requirements of Section 01500.

3.4 DEBRIS HANDLING

- A. Include as debris (as defined in Section 02050) drum/container carcasses (removed empty from the excavation), drum/container parts, large rocks, concrete, and metal which is excavated.
- B. Consider a drum/container to not be debris if more than 1 inch of residue remains on the bottom or if more than 3 percent by weight of drum's/container's capacity remains if capacity is less than 110 gallons or as otherwise defined as hazardous waste in 40 CFR 261.7.
- C. Crush drum and container carcasses and metal.

- D. Place debris in landfill.

3.5 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Control: Field inspection.
- B. Perform work of this Section in the presence of ENGINEER. Do not allow or cause any of the work performed to be covered up or enclosed by work of this Section prior to required inspections, measurements, tests, or approvals.

END OF SECTION

SECTION 02205

SUPPLY OF SOIL MATERIALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Supply and temporary stockpiling common fill for containment cell cap and Site grading.
- B. Supply and temporary stockpiling topsoil for containment cell cap and Site grading.

1.2 RELATED SECTIONS

- A. Section 02207 - Supply of Aggregate Materials.
- B. Section 02223 - Backfilling.
- C. Section 02936 - Seeding.

1.3 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. American Association of State Highway and Transportation Officials (AASHTO): T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-inch (457 mm) Drop.
- C. American Society for Testing and Materials (ASTM):
 - 1. D422 - Standard Test Method for Particle-Size Analysis of Soils.
 - 2. D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 3. D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 4. D2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.
 - 5. D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - 6. D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
 - 7. D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

8. E548 - Standard Guide for General Criteria Used for Evaluating Laboratory Competence.

1.4 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Materials Source: Submit name of proposed imported soil material source at least 14 days prior to commencing transport of materials to Site. Submit evidence for each material source, in the form of chemical analysis, that the material is free of contaminated or toxic substances, to ENGINEER at least 14 days prior to commencing transport of materials to Site.
- C. Geotechnical Data: At least 7 days prior to commencing transport of materials to Site, submit geotechnical data for source testing as specified in Article 2.4 for each type of soil materials.
- D. Chemical Analysis: Submit chemical analytical results for source testing as specified in Article 2.4.
- E. Samples: Submit, in airtight containers, 10-pound sample of fill to analytical testing laboratory engaged by TRUST.
- F. Independent Geotechnical Testing Firm: At least 14 days prior to commencing transport of soil materials to Site, submit the name and qualifications of the independent geotechnical testing firm proposed by CONTRACTOR to provide geotechnical testing services for work of this Section.
- G. Independent Testing Laboratory: At least 14 days prior to commencing transport of soil materials to Site, submit the name and qualifications of the independent testing laboratory proposed by CONTRACTOR to provide chemical analysis for work of this Section.
- H. Suppliers' Certificates: Certify that each type of soil materials meets or exceeds specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform work of this Section in accordance with ASTM standards.

1.6 QUALIFICATIONS

- A. Independent Geotechnical Testing Firm: Company specializing in performing the work of this Section and complying with ASTM D3740.
- B. Independent Laboratory: Company specializing in performing the work of this Section and complying with ASTM E548.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Material and Equipment: Requirements for transporting, handling, storing, and protecting products.

- B. Deliver, handle, and transport soil materials at all times in a manner and with equipment that will prevent intermixing of soil types, segregation, or contamination.
- C. Stockpile fill materials on Site in locations approved by ENGINEER.
- D. Minimize stockpiling requirements. Transport material from source directly to final position where possible.

PART 2 PRODUCTS

2.1 GENERAL

- A. Imported from an approved source.
- B. Free of unsuitable materials including:
 - 1. Frozen material or material containing snow or ice.
 - 2. Trees, stumps, branches, roots, or other wood or lumber.
 - 3. Wire, steel, cast iron, cans, drums, or other foreign material.
 - 4. Materials containing hazardous or toxic constituents at hazardous or toxic concentrations.

2.2 COMMON FILL

- A. Type S1:
 - 1. Imported borrow.
 - 2. Graded.
 - 3. Free of rocks larger than 2.5 inches, loam, organic matter, very soft clays, swelling clays, or fine uniform sands that may be difficult to compact.
 - 4. ASTM D2487 Group Symbol SC, SM, SW-SM, SW-SC, GS, GM with fines (#200 US. Sieve) contents between 5 to 15 percent and gravel fraction (Size No. 4) no more than 25 percent.

2.3 TOPSOIL

- A. Type S2:
 - 1. Imported borrow.
 - 2. Friable loam neither heavy clay nor of very light sandy nature.
 - 3. Reasonably free of roots, rocks, or lumps larger than 1/2 inch, weeds, vegetation, and seeds of noxious weeds.

4. Acidity Range (pH): 6.1 to 7.8.
5. Containing minimum 8 percent and maximum 20 percent organic matter.
6. Having following quotation:

Passing No. 10	85 percent - 100 percent
Clay	5 percent - 30 percent
Silt	10 percent - 70 percent
Sand and gravel	10 percent - 70 percent

2.4 IMPORTED CLAY

A. Type S3:

1. Minimum of 65 percent fines passing No. 200 sieve of which minimum of 25 percent is clay. Gradation limits as follows:

Sieve Size	Percent Passing By Weight
3/4 inch	100
No. 18	85-100
No. 70	75-95
No. 200	65-85
0.005 mm	>25

2. Free of unsuitable materials including:
 1. Materials containing loam, roots, or organic matter.
 2. Frozen material or material containing snow or ice.
 3. Soft and/or organic clays and silts of low strength.
 4. Frost susceptible silts or clays.
 5. Swelling clays.
 6. Rocks greater than 3/4 inch and lumps of material greater than 2 inches.
 7. Contaminated or toxic matter.
3. Moisture content within range of zero to plus 5 percent of optimum moisture content. Plasticity index within range of 15 to 30 percent.
4. Conforming to ASTM D2487 Group Symbol CL or ML.
5. Compactable to minimum of 95 percent of maximum dry density with an in-place permeability of less than 1×10^{-7} cm/s.

2.5 NATIVE CLAY

A. Type S4:

1. Clay excavated on Site.
2. Determined by ENGINEER to be uncontaminated.
3. Conforming to ASTM D2487 Group Symbol CH, CL, or ML.
4. Compactable to a minimum of 95 percent of maximum dry density with an in-place permeability of less than 10^{-7} cm/s.
5. Free of rocks or lumps greater than 2 inches or frozen material.

2.6 SOURCE QUALITY CONTROL

A. Section 01400 - Quality Control: Requirements for source testing and analysis of soil material.

B. Testing and Analyses of Common Fill:

1. Maximum Dry Density, ASTM D698 or ASTM D1557: 1 sample per 10,000 cu yd of material required.
2. Moisture Content, ASTM D2216: 1 sample per 10,000 cu yd of material required.
3. Grain Size, ASTM D422: 1 sample per 10,000 cu yd of material required.
4. Atterberg Limits, ASTM D4318: 1 sample per 10,000 cu yd of material required.
5. Soil Classification, ASTM D2487: 1 sample per 10,000 cu yd of material required.
6. Chemical Analysis, SW-846: 1 sample per material source required, as specified in Section 2207, Article 2.3.B.5.

C. Testing and Analysis of Topsoil:

1. Grain Size, ASTM D422: 1 sample per 10,000 cu yd of material required.
2. pH of Soil, ASTM D4972: 1 sample per 10,000 cu yd of material required
3. Chemical Analysis, SW-846: 1 sample per discrete material source required, as specified in Section 2207, Article 2.3.B.5.
4. Organic Content, SW846 Method 9060: 1 sample per 10,000 cu yd of material required.

D. If tests indicate materials do not meet specified requirements, change material or material source and retest.

E. Provide materials of each type from the same source throughout Works.

- F. In the event of changes to approved sources of materials during the performance of Works, immediately advise ENGINEER of revised locations and obtain approval of such locations and materials prior to use in Works.

PART 3 EXECUTION

3.1 PREPARATION

- A. Obtain ENGINEER's approval to deliver soil material to Site and to place soil material in on-Site stockpiles.

3.2 STOCKPILING

- A. Stockpile materials on Site at locations designated by ENGINEER.
- B. Stockpile in sufficient quantities to meet schedule and requirements.
- C. Construct stockpile sites so that they are level, well drained, free of foreign materials, and of adequate bearing capacity to support the weight of materials to be placed thereon.
- D. Provide and maintain access to stockpiles.
- E. Separate differing materials with substantial dividers or stockpile apart to prevent mixing.
- F. Prevent intermixing of soil types or contamination or segregation.
- G. Direct surface water away from stockpile sites to prevent erosion or deterioration of materials.
- H. Maintain temporary stockpile slopes not steeper than 1.5 horizontal to 1 vertical. In no instance shall stockpiles be greater than 10 feet in height above original surrounding grade. Place hay bales or soil erosion and sediment control fencing at the base of and around each temporary stockpile to contain soil that may be washed off the stockpile.
- I. Maintain area surrounding stockpiles in a neat and tidy condition.

3.3 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in a clean and neat condition. Grade Site surface to prevent freestanding surface water.

END OF SECTION

SECTION 02207

SUPPLY OF AGGREGATE MATERIALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Supply and temporary stockpiling imported coarse aggregate for Site access roads and structure bedding.
- B. Supply and temporary stockpiling imported granular drainage material for leachate collection system and containment cell cap.

1.2 RELATED SECTIONS

- A. Section 02205 - Supply of Soil Materials.
- B. Section 02223 - Backfilling.
- C. Section 02247 - HDPE Liner.

1.3 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. American Society for Testing and Materials (ASTM):
 - 1. C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. D422 - Standard Test Method for Particle-Size Analysis of Soils.
 - 3. D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 4. D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 5. D2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.
 - 6. D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).
 - 7. D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
 - 8. E548 - Standard Guide for General Criteria Used for Evaluating Laboratory Competence.

1.4 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Materials Source: Submit name of proposed imported soil material source at least 14 days prior to commencing transport of materials to Site. Submit evidence for each material source, in the form of chemical analysis, that the material is free of contaminated or toxic substances, to ENGINEER at least 14 days prior to commencing transport of materials to Site.
- C. Geotechnical Data: At least 7 days prior to commencing transport of materials to Site, submit geotechnical data for source testing as specified in Article 2.5 for each type of aggregate materials.
- D. Chemical Analysis: Submit chemical analytical results for source testing as specified in Article 2.5.
- E. Samples: Submit, in airtight containers, 10-pound sample of fill to analytical testing laboratory engaged by TRUST.
- F. Independent Geotechnical Testing Firm: At least 14 days prior to commencing transport of aggregate materials to Site, submit the name and qualifications of the independent geotechnical testing firm proposed by CONTRACTOR to provide geotechnical testing services for work of this Section.
- G. Independent Testing Laboratory: At least 14 days prior to commencing transport of aggregate materials to Site, submit the name and qualifications of the independent testing laboratory proposed by CONTRACTOR to provide chemical analysis for work of this Section.
- H. Suppliers' Certificates: Certify that each type of aggregate material meets or exceeds specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform work of this Section in accordance with ASTM Standards.

1.6 QUALIFICATIONS

- A. Independent Geotechnical Testing Firm: Company specializing in performing the work of this Section and complying with ASTM D3740.
- B. Independent Laboratory: Company specializing in performing the work of this Section and complying with ASTM E548.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Material and Equipment: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver, handle, and transport fill materials at all times in a manner and with equipment that will prevent intermixing of aggregate types, segregation, or contamination.

- C. Stockpile fill materials on Site in locations approved by ENGINEER.
- D. Minimize stockpiling requirements. Transport material from source directly to final position where possible.

PART 2 PRODUCTS

2.1 GENERAL

- A. Imported from an approved source and composed of clean, graded, hard, durable, uncoated particles obtained from deposits of gravel or sand, talus rock, quarried rock, or other suitable granular materials,
- B. Free of unsuitable materials including:
 - 1. Frozen material or material containing snow or ice.
 - 2. Trees, stumps, branches, or other wood or lumber.
 - 3. Wire, steel, cast iron, cans, drums, or other foreign material.
 - 4. Materials containing hazardous or toxic constituents at hazardous or toxic concentrations.

2.2 COARSE AGGREGATE

- A. Type A1: Aggregate for Site access road according to Ohio DOT Item #304.
- B. Type A2: Granular Cap Drainage Layer aggregate; within the following limits:

<i>ASTM Sieve Size</i>	<i>Percent Passing By Weight</i>
3/8 inch (9 mm)	100
No. 4	90 to 100
No. 10	45 to 90
No. 40	15 to 45
No. 200	0 to 3

- C. Type A3: Granular aggregate for leachate collection containment cell bottom drainage layer according to Ohio DOT size No. 78 Table 703-1.

2.3 SOURCE QUALITY CONTROL

- A. Section 01400 - Quality Control: Requirements for source testing and analysis of aggregate material.
- B. Testing and Analysis of Aggregate Type A1, Type A2, and Type A3:
 - 1. Maximum Dry Density, ASTM D698: 1 sample per 1,000 cu yd of material required.

2. Grain Size, ASTM D422 or ASTM C136: 1 sample per 1,000 cu yd of material required.
3. Moisture Content, ASTM D2216: 1 sample per 1,000 cu yd of material required.
4. Recompacted Permeability, ASTM D2434: 1 sample per 3,000 cu yd of material required.
5. Chemical Analyses, SW-846: At least 1 sample for each source for the following analysis:

<i>Parameter</i>	<i>Extraction/Preparation⁽¹⁾</i>	<i>Analysis⁽¹⁾</i>
TCL ⁽²⁾ Volatile Organic Compound	5050	8260 and 8240
TCL Semi-Volatile Organic Compound	3540/3550	8270
Pesticide/PCB	3540/3550	8080
TAL ⁽³⁾ Inorganics	3050	6010/7000 Series

Notes:

- (1) Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", EPA SW-846, 3rd Edition, September 1986.
- (2) TCL - Target Compound List.
- (3) TAL - Target Analyte List.

- C. If tests indicate materials do not meet specified requirements, change material or material source and retest.
- D. Provide materials of each type from the same source throughout Works.
- E. In the event of changes to approved sources of materials during performance of Works, immediately advise ENGINEER of revised locations and obtain approval of such locations and materials prior to use in Works.

PART 3 EXECUTION

3.1 PREPARATION

- A. Obtain ENGINEER's approval prior to placing material in on-Site stockpiles.

3.2 STOCKPILING

- A. Stockpile materials on Site at locations directed by ENGINEER. The landfill base may be used for stockpiling only after completion of grading and confirmatory testing.
- B. Stockpile in sufficient quantities to meet schedule and requirements.

- C. Construct stockpile sites so that they are level, well drained, free of foreign materials, and of adequate bearing capacity to support the weight of materials to be placed thereon.
- D. Provide and maintain access to stockpiles.
- E. Separate differing materials with substantial dividers or stockpile apart to prevent mixing.
- F. Prevent intermixing of soil types or contamination or segregation.
- G. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
- H. Maintain temporary stockpile slopes not steeper than 1.5 horizontal to 1 vertical. In no instance shall stockpiles be greater than 10 feet in height above original surrounding grade. Place hay bales or soil erosion and sediment control fencing at the base of and around each temporary stockpile to contain soil that may be washed off the stockpile.
- I. Maintain area surrounding stockpiles in a neat and tidy condition.

3.3 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in a clean and neat condition. Grade Site surface to prevent freestanding surface water.

END OF SECTION

SECTION 02222

EXCAVATING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Excavating sludge and visually contaminated soils at Lagoon No. 1, No. 2, No. 3, No. 4, No. 5, No. 6, and No. 7.
- B. Excavating other areas of visually contaminated soil.
- C. Excavating contaminated soil as directed by ENGINEER.
- D. Excavating for containment cell.
- E. Excavating for manhole.
- F. Excavating for access roads and drainage ditches.
- G. Excavating for culverts and riprap apron.
- H. Excavating for electrical conduit.

1.2 RELATED SECTIONS

- A. Section 02100 - Site Preparation.
- B. Section 02205 - Supply of Soil Materials.
- C. Section 02207 - Supply of Aggregate Materials.
- D. Section 02607- Manholes and Culverts.
- E. Section 02276 - Temporary Erosion and Sediment Control.

1.3 DEFINITIONS

- A. Excavation: Removal of materials of whatever nature encountered, whether wet, frozen, or otherwise, including dense tills, hardpan, frozen materials, cemented materials, concrete and asphalt pavement, boulders or rock fragments, and weathered rock which can be removed by ripping or excavating with heavy-duty mechanical construction equipment without drilling and blasting.
- B. Initial Lagoon Excavation Limits: Areal excavation limits shown on Drawings to specified depth of 6 inches past extent of visual contamination or as directed by ENGINEER.

- C. Initial Non-Lagoon Excavation Limits: Areal excavation limits shown on Drawings to depth of 2 feet below existing grade or as directed by ENGINEER.
- D. Additional Excavation: Excavation beyond initial lagoon excavation limits either areally or in depth and in non-lagoon areas, as directed by ENGINEER following sampling and analysis (and including trench excavations).

1.4 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Detailed Landfill Development Plan: Within 15 days of Notice to Proceed, submit a Detailed Landfill Development Plan based on Preliminary Landfill Development Plan submitted with bid incorporating and addressing review comments provided by ENGINEER and TRUST, demonstrating compliance with specified requirements and to permit ENGINEER to schedule testing and measurement activities. Include written procedures, schedules, and drawings as applicable and, at a minimum, address each of the following items:
 - 1. Methods and procedures which will be used to perform excavations.
 - 2. Sequencing and scheduling of excavation and backfilling in excavation areas, including allowances for time required for sampling and analysis by ENGINEER.
 - 3. Sequencing and scheduling of shoring installation and removal if applicable.
 - 4. Sequencing for loading and transportation of sludge and soils to soil stabilization area.
 - 5. Sequencing and layout of access routes to and from excavation areas.
 - 6. Methods and procedures which will be implemented to prevent contaminant tracking and cross-contamination.
 - 7. Methods and procedures which will be used to perform additional excavation in open excavations.
 - 8. Sequencing and scheduling of stockpiling operations.
 - 9. Anticipated crew sizes, manhours, types of equipment, and equipment hours on a weekly basis.
 - 10. Dust control measures to be employed during excavation.
- C. Design Data: Shoring Plan and Design (if applicable): Prior to commencing excavation, submit a detailed Shoring Plan and Design. Include existing conditions, written procedures, schedules, design calculations, design assumptions, and design drawings. Shoring drawings shall be reviewed and stamped by a professional engineer registered in State of Ohio. Provide a copy of required shoring permits.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Section 01500 - Construction Facilities and Temporary Controls: Requirements for temporary controls.
- B. Protect open excavations against damage due to surface runoff and runoff. Take necessary precautions to prevent erosion of excavated or disturbed surfaces.
- C. Suspend operations whenever climatic conditions, as determined by ENGINEER, are unsatisfactory for placing fill to the requirements of this Section.
- D. After occurrence of heavy rains, do not operate equipment on approved excavations until the material has dried sufficiently to prevent occurrence of excessive rutting.
- E. Decontaminate equipment involved in excavation activities which may have come in contact with potentially contaminated material before being removed from Site or being relocated to clean areas of Site.
- F. Do not obstruct flow of surface drainage or natural watercourses.

1.6 EXISTING CONDITIONS

- A. Excavation Areas: Define boundaries of excavation as shown on Drawings and as determined in field by ENGINEER.

1.7 SEQUENCING AND SCHEDULING

- A. Section 01015 - General Requirements: Requirements for coordination.
- B. Sequence and schedule excavation activities with work of other Sections.
- C. Do not commence excavation operations until Site-specific Health and Safety Plan has been reviewed by ENGINEER and implemented, and decontamination facilities and stockpiling facilities are constructed and operational.
- D. Excavate areas shown on Drawings in an approved sequence. Submit proposed sequencing changes to ENGINEER in writing. Such changes, if approved, will be authorized by ENGINEER in writing.
- E. Coordinate and sequence excavation operations to minimize the need for temporary stockpiling of excavated materials until required for backfilling. Make every effort to balance cut and fill operations and to ensure that excavated material designated for backfill is immediately placed as backfill in Works. Keep the time during which excavations remain open to the practicable minimum.
- F. Do not allow or cause any of work performed to be covered up or enclosed prior to required inspections, tests, or approvals.
- G. Unless otherwise specified, advise ENGINEER a minimum of 48 hours in advance of excavation operations to enable ENGINEER to take pre-excavation cross-sections.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01015 - General Requirements: Verification of existing conditions before starting work.
- B. Verify that survey bench marks and intended elevations for Works are as shown on Drawings.
- C. Monitoring Wells: ENGINEER will locate and mark the location of monitoring wells prior to commencement of excavation.
- D. Excavation Areas: ENGINEER will define the boundaries of contaminated soil excavation as shown on Drawings, and as determined in the field by ENGINEER, based on visual observations and analytical results of soil samples collected from the base and walls of excavations or existing ground surface.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities from damage.
- C. Protect bench marks, survey control points, existing structures, fences, from excavating equipment and vehicular traffic.
- D. Protect existing buildings and surface features which may be affected while work is in progress.
- E. Protect excavations from contamination.
- F. Provide temporary erosion and sediment control measurements.

3.3 EXCAVATING

- A. Excavate to lines, grades, elevations, and dimensions shown on Drawings or as directed by ENGINEER.
- B. Transfer excavated material to designated fill area as directed by ENGINEER.
- C. Slope banks with machine to angle of repose or less until shored.
- D. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- E. Remove debris and other obstructions encountered.

- F. Notify ENGINEER of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
- G. Hand trim, make firm, and remove loose material and debris from excavations. Where natural or fill material at bottom of excavation is disturbed, compact disturbed soil to density at least equal to undisturbed soil or to the density specified for the succeeding layer of backfill, whichever is greater, or remove disturbed soil and refill the space as directed by ENGINEER.
- H. Stockpile excavated material approved for reuse by ENGINEER in area designated on-Site in accordance with Section 02205.
- I. Leave excavations open pending sampling and analysis by ENGINEER. ENGINEER may direct additional excavation or backfilling based on analytical results.
- J. Open excavations shall be CONTRACTOR's sole responsibility.

3.4 EXCAVATING OF CLAY

- A. Excavate clay from designated on-Site area as directed by the ENGINEER.
- B. Select and stockpile excavated material conforming to following specification:
- C. Free of unsuitable materials including:
 - 1. Materials containing loam, roots, or organic matter.
 - 2. Frozen material or material containing snow or ice.
 - 3. Soft and/or organic clays and silts of low strength.
 - 4. Frost susceptible silts or clays.
 - 5. Swelling clays.
 - 6. Rocks greater than 1 inch and lumps of material greater than 2 inches.
 - 7. Contaminated or toxic matter as determined by ENGINEER.
- D. Moisture content within range of zero to plus 5 percent of optimum moisture content. Plasticity index within range of 15 to 30 percent.
- E. Conforming to USDA Group Symbol CL or ML.
- F. Compactable to minimum of 95 percent of maximum dry density with an in-place permeability of less than 1×10^{-7} cm/s.
- G. Approved for use intended by ENGINEER.

3.5 CONTAINMENT CELL

- A. The containment cell shall be underlain by a minimum thickness of 4 feet of clay with a maximum permeability of 10^{-7} cm/sec. The in-place thickness and permeability shall be verified by conducting soil borings with Shelby tube equipment. The CONTRACTOR shall employ a driller licensed in the State of Ohio to conduct the soil borings. The borings shall be taken as shown on the Drawings with an additional 5 borings to be taken at locations specified by the USEPA.
 - 1. Undisturbed samples will be collected by the CONTRACTOR at 1-foot intervals and submitted to an independent geotechnical laboratory for determination of particle size and Atterburg limits. One sample, as directed by the ENGINEER, per boring will be tested for permeability. Boreholes shall be backfilled with bentonite hole plug material.
- B. Notify ENGINEER when soil at the bottom or walls of the excavation appears unsuitable and proceed as directed by ENGINEER. Where, in ENGINEER's opinion, the undisturbed condition of the soils is inadequate for the construction of the landfill base, over-excavate to adequate soils or to a depth of 4 feet as directed by ENGINEER and refill the excavated space with approved material to the proper elevation in accordance with the procedure specified for backfill. Where so directed by ENGINEER and except as otherwise specified, the excavation and removal of inadequate material as specified, supply and installation of such material in excess of quantities shown on Drawings will be paid for under the appropriate item of Schedule of Prices. Use such over-excavated material in Works or stockpile on Site as approved by ENGINEER. Over excavated and backfilled area shall be tested in accordance with Article 3.8.C 3 of Section 02223.
- C. The CONTRACTOR shall allow for sufficient time in the construction schedule for the testing and approval of the contaminant cell bottom by the ENGINEER and USEPA.
- D. Backfill in accordance with Section 02223.
- E. Should unauthorized excavation be carried below the lines and grades shown on Drawings and in excess of specified limits and tolerance because of CONTRACTOR's operations including errors, methods of construction, or to suit his convenience, correct unauthorized excavation as follows:
 - 1. Fill under concrete structures with concrete.
 - 2. Fill under unauthorized over-excavation areas by extending the indicated bottom elevation of the base of the material specified to be placed to the unauthorized excavation bottom without altering the required top elevation and compact in accordance with Section 02223 unless otherwise directed by ENGINEER.
- F. Additional excavation to remove weakened or disturbed soil caused by CONTRACTOR's error, unsuitable construction methods or procedures, or to suit CONTRACTOR's convenience and subsequent additional backfill and compaction to correct deficiencies shall be at no additional cost to TRUST.

3.6 PROTECTING CLEAN SOIL FROM CONTAMINATION

- A. Notify ENGINEER when soil at the bottom of the excavation appears contaminated and proceed as directed by ENGINEER.

- B. Prevent contamination of adjacent clean soil.
- C. Place plastic sheeting and plywood under excavation equipment and alongside the excavation to prevent contaminated soil from being mixed with surrounding clean soil. Use other means of preventing contamination subject to approval by ENGINEER. Do not mix excavated soil with imported materials unless otherwise directed by ENGINEER. Place excavated soil adjacent to excavation in compliance with OSHA requirements.
- D. Clean stockpiled excavated soils will be considered native fill for the purpose of backfilling.
- E. Decontaminate excavation equipment after handling contaminated materials and prior to handling clean overburden. Decontaminate shoring or falsework prior to reuse. ENGINEER will direct additional decontamination as necessary in the opinion of ENGINEER.

3.7 TEMPORARY STOCKPILING

- A. Obtain ENGINEER's approval for locations of temporary stockpiles. Obtain ENGINEER's approval prior to placing material in such stockpiles.
- B. Stockpile excavated materials on Site in accordance with Section 02205.

3.8 TOLERANCES

- A. Within 0.15 feet greater or less than specified depth but not uniformly greater or less.

3.9 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Control: Field inspection and testing.
- B. Provide for visual inspection of bearing surfaces.
- C. The bank and bottom soils of the lagoons and other soil locations as directed by ENGINEER to determine if contaminants have been removed according to Section 02750.
- D. Conduct soil borings in areas indicated by ENGINEER to verify thickness and permeability of native clay or backfill.

3.10 CLEANING

- A. Section 01700 - Contract Closeout: Requirements for cleaning installed work.
- B. Clean and reinstate work areas and areas affected by equipment outside areas specified to be excavated, to specified restoration condition.

3.11 PROTECTION OF FINISHED WORK

- A. Section 01500 - Construction Facilities and Temporary Controls: Requirements for protecting installed work.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

SECTION 02223

BACKFILLING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Backfilling for construction of on-Site containment cell.
- B. Site filling for regrading of all excavated areas.
- C. Backfilling for on-Site containment cell cap.
- D. Fill under manhole and equipment decontamination pad.
- E. Fill for access road and culverts.
- F. Fill for over-excavation.
- G. Consolidation and compaction as scheduled.
- H. Backfilling for electrical conduit.

1.2 RELATED SECTIONS

- A. Section 02205 - Supply of Soil Materials.
- B. Section 02207 - Supply of Aggregate Materials.
- C. Section 02222 - Excavating.
- D. Section 02243 - Geotextile.
- E. Section 03300 - Cast-in-Place Concrete: Concrete materials.

1.3 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. American Association of State Highway and Transportation Officials (AASHTO): T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-inch (457 mm) Drop.
- C. American Society for Testing and Materials (ASTM):
 - 1. D422 - Standard Test Method for Particle-Size Analysis of Soils.

2. D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 3. D1140 - Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75-μm) Sieve.
 4. D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 5. D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 6. D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 7. D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 8. D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
 9. D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 10. D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 11. D5084 - Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
 12. D5093 - Standard Test Method for Field Measurement of Infiltration Rate Using a Double Ring Infiltrometer with a Sealed-Inner Ring.
- D. United States Environmental Protection Agency (USEPA): SW-846 - Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Third Edition.

1.4 DEFINITIONS

- A. SMDD: Standard Maximum Dry Density and in the context of this Contract means the maximum dry unit weight determined in accordance with ASTM D698.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Common fill (Type S1): Section 02205.
- B. Topsoil (Type S2): Section 02205.
- C. Imported clay (Type S3): Section 02205.

- D. Native clay (Type S4): Section 02205.
- E. Coarse Aggregate Type A1: Section 02207.
- F. Granular Cap Drainage Layer Aggregate Type A2: Section 02207.
- G. Granular Aggregate Leachate Collection Drainage Layer Type A3: Section 02207.
- H. Geotextile: Section 02243.
- I. Other ENGINEER-Approved Material.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01015 - General Requirements: Verification of existing conditions before starting work.
- B. Do not allow or cause any of the work performed or installed to be covered up or enclosed by work of this Section prior to required inspections, measurements, tests, or approvals.
- C. Obtain approval from ENGINEER for completed excavations and previously placed material prior to placement of successive lifts.
- D. Obtain approval from ENGINEER prior to placing fill against structures or around exposed buried utilities.
- E. Do not proceed with backfilling operations within a specific excavation area until the excavation area is approved as complete by ENGINEER. Do not cause excavations to be backfilled until ENGINEER has approved excavation as complete and completed field measurements for payment purposes, and sampling and testing for analytical purposes.
- F. Ensure areas to be backfilled are free from debris snow, ice, water, or frozen ground.

3.2 PREPARATION

- A. Compact subgrade to density requirements for subsequent backfill materials.
- B. Remove debris, snow, ice, water, or frozen ground from areas to be backfilled.
- C. Scarify subgrade surface to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.
- D. Decontaminate equipment which has handled contaminated or potentially contaminated material at the decontamination area prior to being used for backfilling operations.

3.3 CLAY TEST PAD

- A. Prior to constructing clay isolation barrier or landfill clay liners, construct clay layer test pad using native clay material (Type S4), or imported clay, if required (Type S3), on portion of regraded and proofrolled area of Site with native clay as approved by ENGINEER.
- B. Construct test pad using same construction methods and equipment intended for actual construction.
- C. Construct test pad for each change in material source and when directed by ENGINEER for quality control tests.
- D. Minimum Width of Test Pad: 4 times width of compaction equipment.
- E. Minimum Length of Test Pad: 4 times length of compaction equipment (including power equipment and any attachments).
- F. Minimum Thickness of Test Pad: 4 feet.
- G. Testing of Test Pad Construction as follows:
 - 1. Density: ASTM D2922, 2 per lift.
 - 2. Moisture Content: ASTM D3017, 2 per lift (verify with ASTM D2216 at frequency 1 per lift).
 - 3. In Situ Hydraulic Conductivity: ASTM D5084, 1 per lift.
 - 4. Grain Size: ASTM D422, 1 per lift.
 - 5. Atterberg Limit: ASTM D4318, 1 per lift.
- H. If test pad fails permeability requirements specified for Type S1 clay material, modify construction methods and/or equipment, reconstruct test pad with same material and retest.
- I. Clay material failing placed performance criteria will not be approved for use in constructing clay isolation barrier or clay liners.

3.4 BACKFILLING

- A. Backfill areas to grades and elevations shown on Drawings.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Place geotextile fabric over landfill drainage layer prior to placing next lift of fill, according to Section 02243.
- D. Aggregate Type A1, A2, and A3. Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.

- E. Soil Type S1: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.
- F. Excavated Native Clay Material Suitable for Backfill (Type S4), imported clay (Type S3) as needed and topsoil Type S2: Place and compact material in equal continuous layers not exceeding 6 inches compacted depth.
- G. Employ a placement method that does not disturb or damage other work.
- H. Maintain optimum moisture content of backfill materials to attain required compaction density.
- I. Make gradual grade changes. Blend slope into level areas.
- J. Leave fill material stockpile areas free of excess fill materials.
- K. Use fill types as specified. Completely use select native fill approved for backfilling before using imported fill.
- L. Do not use backfill material which is determined unsuitable by ENGINEER.
- M. Backfill around exposed utilities by placing layers simultaneously on all sides to equalize loading. Do not dump directly against monitoring wells, utilities, or foundations.
- N. Do not operate heavy compaction equipment closer than 3 feet to foundations, underground utilities, or monitoring wells.
- O. Remove sheeting and shoring required during excavation during backfilling operations. Do not remove bracing until backfilling has reached the respective level of such bracing. Pull sheeting in increments that will ensure compacted backfill is maintained at an appropriate elevation at least 20 inches above toe of sheeting.
- P. Decontaminate or dispose of sheeting and shoring used during Works as directed by ENGINEER.
- Q. Do not backfill around or over cast-in-place concrete within 7 days of concrete placing.
- R. Backfill around installations as follows:
 - 1. Place bedding and surround material for pipe installation in accordance with Section 02207.
 - 2. Place layers simultaneously on both sides of installed work to equalize loading and minimize movement.
 - 3. Place material by hand under, around, and over installations until 2 feet of cover is provided. Do not dump material directly on installations.
- S. Except as specified otherwise, place backfill continuously and in uniform layers not exceeding specified compacted thickness up to grades shown on Drawings.
- T. Compact each layer to specified density before placing succeeding layers in accordance with Article 3.6.

3.5 PLACING TOPSOIL

- A. Spread topsoil to minimum settled depth of 6 inches over area to be seeded. Rake until smooth.
- B. Place topsoil during dry weather and on dry unfrozen subgrade.
- C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.
- D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

3.6 COMPACTION

- A. Compact aggregate materials to 90 percent SMDD.
- B. All other soil materials: Compact to 95 percent SMDD.
- C. Apply potable water as necessary during compaction to obtain specified density. If material to be compacted is excessively moist, aerate with suitable equipment and methods until the moisture content is corrected. In areas not accessible to rolling equipment, compact material to specified density with mechanical tampers approved by ENGINEER.
- D. When granular material is wetted by sprinkling, after being spread on material in place, sprinkling shall be done by method approved by ENGINEER. Do not direct jets of water at fill with such force that finer materials will be washed out.
- E. Compaction Equipment: The type, size, and efficiency of compaction equipment shall be capable of achieving specified degree of compaction. When operating equipment adjacent to and immediately above structures, exercise care so as not to cause damage or displacement of the structure.

3.7 TOLERANCES

- A. Top Surface of Backfilling: Plus or minus 0.1 foot from required elevations.
- B. Top Surface of General Backfilling: Plus or minus 0.1 foot from required elevations.

3.8 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Control: Field inspection and testing.
- B. Testing by ENGINEER:
 - 1. ENGINEER may select samples of uncompacted fill intended for Works and samples of compacted fill in Works.
 - 2. ENGINEER will perform tests in the field and in the laboratory on samples of backfill and imported fill to determine if materials meet specification. Testing of imported fill will

include analysis for the presence of contaminants, grain size analysis, moisture content determination, bulk wet density, maximum dry density, and permeability. Testing for backfill will include moisture content determination, maximum dry density, and bulk wet density and permeability. Copies of test reports will be supplied to CONTRACTOR on request. This testing is in addition to testing by CONTRACTOR as specified in Section 02205 and Section 02207.

3. Testing by ENGINEER will in no way relieve CONTRACTOR of his responsibility to test all material prior to notifying ENGINEER of materials' suitability for the work involved.

C. Methods of Testing:

1. Maximum dry density will be determined in the laboratory in accordance with ASTM D698.
2. Moisture content in the laboratory will be determined in accordance with ASTM D2216.
3. Bulk wet density will be determined in the field in accordance with ASTM D2922 or with ASTM D1556 with dimensions of apparatus modified to suit soil tested or with ASTM D2167 whichever is most suitable to obtain representative density of soil tested.
4. Moisture content will be determined in the field in accordance with ASTM D3017.
5. Particle size analysis will be performed in accordance with ASTM D422 or ASTM D1140, whichever is appropriate to material being tested.
6. Permeability will be determined in accordance with ASTM D2434 on a representative sample compacted in the laboratory to the field bulk wet density and moisture.
7. Chemical characterization will be performed in the laboratory as specified in Section 02207.

D. Frequency of Testing by CONTRACTOR:

1. During Placement for Containment Cell and On-Site Road Construction:

<i>Parameter</i>	<i>Method</i>	<i>Type S1</i>	<i>Type A1</i>	<i>Type A2 and A3</i>	<i>Type S3 & S4 Material</i>
In Situ Density	ASTM D2922	1/10,000 sq ft/lift	1/10,000 sq ft/lift	1/10,000 sq ft/lift	1/10,000 sq ft/lift
In Situ Moisture Content	ASTM D3017	1/10,000 sq ft/lift	1/10,000 sq ft/lift	1/10,000 sq ft/lift	1/10,000 sq ft/lift
Max. Dry Density	ASTM D698	1/10,000 sq ft/lift	1/10,000 sq ft/lift	1/10,000 sq ft/lift	1/10,000 sq ft/lift
Permeability	ASTM D2434	--	--	1/25,000 sq ft/lift	--
Permeability	ASTM D5084	--	--	--	1/25,000 sq ft/lift

2. During Placement for Site Regrading:

<i>Parameter</i>	<i>Method</i>	<i>Type S1</i>
In Situ Density	ASTM D2922	5/acre/lift
In Situ Moisture Content	ASTM D3017	5/acre/lift
Max Dry Density	ASTM D698	5/acre/lift

- E. Failure to Meet Specified Requirements: If tests indicate that material specifications have not been achieved or cannot be obtained with equipment in use, procedure being followed, or material being incorporated, remove and replace work and modify operations so that the equipment, procedures, and materials will produce the required results. Additional testing required by ENGINEER will be to CONTRACTOR's account.

3.9 ADJUSTING

- A. Finish compacted surfaces to within 0.1 foot of grades shown on Drawings but not uniformly high or low. Correct surface irregularities by loosening and adding or removing material until the surface is within specified grade.
- B. Leave work areas in a properly graded condition sloped as required to permit proper drainage and free of depressions that will pond or collect water or debris that will restrict flow.

3.10 CLEANING

- A. Section 01700 - Contract Closeout: Requirements for cleaning installed work.
- B. Clean and reinstate work areas and areas affected by equipment outside areas specified to be excavated, to specified restoration condition.
- C. Upon completion of backfilling, remove excess material and debris from work areas and travel routes.

3.11 PROTECTION OF FINISHED WORK

- A. Section 01500 - Construction Facilities and Temporary Controls: Requirements for protecting installed work.
- B. Reshape and recompact fills subjected to vehicular traffic.

END OF SECTION

SECTION 02240

SLUDGE AND SOIL REMOVAL AND STABILIZATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Dewatering of lagoons.
- B. Disposal of liquids to on-Site wastewater treatment plant including collected rainwater and groundwater entering excavation areas.
- C. Completion of a successful System Performance Test.
- D. *Stabilization of existing sludge, soils, and compatible drummed waste by adding stabilization additives and blending them using suitable equipment.*
- E. Excavating sludge from lagoons 1, 2, 3, 4, 5, 6, and 7.
- F. Sampling and analysis of stabilized sludge to demonstrate performance criteria.
- G. Placement of stabilized materials at on-Site landfill.

1.2 RELATED SECTIONS

- A. Section 02757 - Wastewater Treatment: Management and disposal of treated wastewater.
- B. Section 02750 - Sampling and Chemical Analysis: Collection and analysis of confirmatory soil and stabilized sludge and soil samples.

1.3 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. ASTM C150 - *Standard Specification for Portland Cement.*
- C. ASTM C618 - *Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.*
- D. ASTM D2850 - *Standard Test Method for Unconsolidated, Undrained Compressive Strength of Cohesive Soil in Triaxial compression.*
- E. ASTM 1557 - *Modified Proctor Density.*
- F. ASTM D2166 - *Standard Test Method for Unconfined Compressive Strength of Cohesive Soil.*
- G. Ohio Administrative Code 3745-31-05 and 3745-17-11.

- H. USEPA SW-846 - Test Method for Evaluating Solid Wastes, Physical/Chemical Methods, Methods 9095 and 9096.
- I. ASTM D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- J. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.4 DEFINITIONS

- A. Sludge: material present in lagoons 1N, 1S, 6 and 7 and Cell 1 of the landfill including but not limited to soil, organic matter, sludge, partially stabilized sludge, sediment, oil, grease, and associated chemical constituents.
- B. Soil: material, other than sludge, demonstrating a headspace reading of greater than 200 ppm. The following procedure will be used for the headspace analysis:
 - 1. Use photoionization detectors (PIDs) with a 10.2 eV (+/-) or greater lamp source, or flame ionization detectors (FIDs). Perform PID or FID instrument calibration on Site and at least daily to yield "total organic vapors" in volume parts per million (v/v) of a benzene equivalent. Follow the manufacturer's instructions for operation, maintenance and calibration of the instrument. Keep calibration records.
 - 2. Use a self-sealing quart-size polyethylene freezer bag. Half-fill the bag with the sample to be screened so the volume ratio of soil to air is equal, then immediately seal it. Manually break up the soil clumps within the bag. Note: soil collected from a split spoon should be transferred to the bag immediately after opening the split spoon; soil collected from an excavation or soil pile should be collected from freshly exposed surfaces.
 - 3. Allow headspace development for at least 10 minutes. Vigorously shake bags for 15 seconds both at the beginning and end of the headspace development period. Headspace development decreases with temperature. When temperatures are below the operating range of the instrument perform headspace development and analysis in a heated vehicle or building. Record the ambient temperature during headspace screening. Complete headspace analysis within approximately 20 minutes of sample collection.
 - 4. Following headspace development introduce the instrument sampling probe through a small opening in the bag to a point about one-half of the headspace depth. Keep the probe free of water droplets and soil particles. (Syringe withdrawal of a headspace sample and injection to an instrument probe or septum-fitted inlet is acceptable, provided the method accuracy is proven by means of a test gas standard.)
 - 5. Record the highest meter response. Maximum response usually occurs within about two seconds. Erratic meter response may occur at high organic vapor concentrations or if moisture is present. Note any erratic headspace data.

1.5 SYSTEM DESCRIPTION

- A. Section includes addition of stabilization additives (any, or a combination of sand, flyash, cement, lime, calcined gypsum, etc.) using suitable ex situ mixing equipment to existing sludge and soils to increase physical and chemical stability of the materials to meet performance standards specified in Article 1.6. Stabilized sludge and soils and some non-stabilized soil and debris will be excavated, transported to, and placed in an on-Site Landfill.
- B. Employ the 'best available technology' in the design of the air pollution control systems, and ancillary facilities, in accordance with 40 CFR 52.21(b)(12) and OEPA Revised Code 3704.01. The Air Pollution Control Equipment shall:
 - 1. Be capable of controlling gaseous, particulate, and aerosol type emissions from the stabilization equipment as required by the performance criteria and by other applicable emission standards.
 - 2. Include an exhaust stack and fan system which meets OEPA or USEPA standards for good engineering practice.
 - 3. Provide stabilization equipment with an induced draft fan to prevent fugitive emissions.
- C. Different methods for introducing stabilization additives to sludge and soil will be considered in the review of the Stabilization Plan.
- D. Drawings identify surface area dimensions, elevations, and estimated depth of sludge and sediments to be removed.
- E. To minimize stabilization additive requirements and to allow materials to be placed in on-Site landfill (which requires passing a paint-filter test) it is necessary to dewater lagoons to maximum extent possible and to control sources of water flowing into work areas. Waters entering work areas will be treated as specified in Section 02757.

1.6 PERFORMANCE REQUIREMENTS

- A. Thoroughly mix stabilizing additives with sludge, soil, and compatible drummed waste to ensure uniform physical properties.
- B. Stabilized sludge and soil to have a minimum compressive strength of 1.5 tsf (20.8 psi), as measured by ASTM 2166 (for cementitious samples) or ASTM 2850 (for soil-like samples), contain no free liquid as determined in accordance with SW-846 Method 9095.
- C. Stabilized soil and stabilized sludge to be capable of being landfilled and compacted to 90 percent of Standard Proctor Density using CONTRACTOR's proposed equipment.
- D. Stabilized soil and sludge shall demonstrate compliance with the USEPA TCLP test.
- E. Performance requirements presented in Paragraph 1.6 to be demonstrated as attainable prior to placement in on-Site landfill.
- F. Compliance with the performance requirements presented in Paragraphs 1.6 B will be demonstrated by showing correlation with short-term strength results from System Performance

Test to be conducted as part of startup procedures. Operational monitoring will include field tests, such as nuclear density and pocket penetrometer, that will be used to measure in-place density which, in turn, will be correlated with compressive strength using correlations developed during startup procedures.

- G. Air Pollution Control System shall provide an overall VOC removal efficiency of at least 90 percent and meet all applicable Threshold Limit Values established by OEPA.

1.7 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Detailed Stabilization Plan: Submit Detailed Stabilization Plan based on Preliminary Stabilization Plan submitted with bid incorporating and addressing review comments provided by ENGINEER and TRUST within 15 days after the date of Notice to Proceed. Include mixing methods for stabilization operations, sequence of operations, access, laydown area requirements, and equipment to be used.
 - 1. Methods and procedures which will be used to remove sludge from lagoons.
 - 2. Equipment, methods, and procedures for dewatering, surface water and dust control.
 - 3. Sequencing and scheduling of sludge removal, landfill construction and backfilling including allowances for time required for inspection and testing as specified in this Section.
 - 4. Air Pollution control equipment and operating details.
- C. Daily Operating Report: Submit within 24 hours of completion of an operation, a daily operating report, which includes, but is not limited to, the following:
 - 1. A running summary of operation to date including days operated, volume on each day, operating hours each day, cumulative volume, and cumulative operating hours.
 - 2. Operator's field notes which describe starting and stopping times, starting and finishing volume, all pertinent operating details, all automatic fee cutoff events, and any unusual event.
 - 3. Operator's field notes, as described above, edited if necessary.
 - 4. A minute-by-minute operating summary of all air pollution control equipment operating parameters including, but not limited to:
 - 1. Primary chamber temperature.
 - 2. Gas velocity.
 - 3. Feed rate.
 - 4. Primary chamber feed material exit temperature.

5. Time.

6. Identification of cutoff events.

- D. Record Documents: Indicate quantities of **stabilization additives used**, number of samples submitted, and amount of excavated **stabilized mixture taken to on-Site landfill**.

1.8 QUALITY ASSURANCE

- A. Perform work of this Section in accordance with requirements specified in Article 3.8 of this Section.

1.9 QUALIFICATIONS

- A. CONTRACTOR: Company specializing in performing work of this Section with minimum 3 years documented experience.
- B. Independent Geotechnical Testing Firm: Company specializing in testing physical characteristics of stabilized sludge and stabilized soil with minimum 3 years documented experience.

1.10 PRE-INSTALLATION MEETING

- A. Section 01015 - General Requirements: Requirements for pre-installation meeting.
- B. Convene 1 week prior to commencing work of this Section.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Material and Equipment: Requirements for transporting, handling, storing, and protecting products.
- B. Protect stabilization additive materials from wind, rain, and humidity and store and handle in such manner as to minimize generation of dust and airborne particulates and to control particle agglomeration.

1.12 ENVIRONMENTAL REQUIREMENTS

- A. Section 01500 - Construction Facilities and Temporary Controls: Requirements for temporary controls.
- B. Suspend operations whenever climatic conditions, as determined by ENGINEER, are unsatisfactory for meeting requirements of this Section.

C. Runoff Control:

1. Keep work area dewatered during stabilization activities. Direct surface runoff collected within work area, during stabilization of sediment or sludge, to on-Site wastewater treatment plant specified in Section 02757.
2. Ensure runoff from work area does not flow into or over adjacent lands, in accordance with Section 02276. Restore areas impacted as result of inadequate surface runoff control.

D. Air Emissions Control: Transport, store, and mix specified stabilization additives in such manner as to minimize generation of dust and release of VOC gases. Include in Detailed Stabilization Plan submittal, material handling procedures and dust control measures sufficient to minimize or eliminate dust generation.

E. Do not stabilize sludge and soil with additives when winds would cause excessive dust or when temperature is too low for proper stabilization and landfill placement.

F. Do not place stabilized material which is in frozen state into on-Site landfill.

G. Collect animals stranded or endangered by dewatering or other activities which can be humanely captured and transported unharmed, and release as directed by ENGINEER. Rinse animals with potable water upon capture.

H. After occurrence of heavy rains, do not operate equipment on previously placed material or on approved excavations until material has dried sufficiently to prevent occurrence of excessive rutting.

I. Where excavations or previously placed material have been softened or eroded, remove soft and yielding material or otherwise objectionable or damaged areas and replace with compacted fill as specified by ENGINEER.

1.13 EXISTING CONDITIONS

A. Seven separate lagoons exist within the Site where sludge and water levels vary from lagoon to lagoon.

B. All existing main and storm sewers and utilities will remain in service. Replace or repair damaged items as specified by ENGINEER.

1.14 SEQUENCING AND SCHEDULING

A. Section 01015 - General Requirements: Requirements for coordination.

B. Sequence work to commence after a portion of on-Site landfill and temporary Wastewater Treatment Facility are ready to receive waste and are operational.

C. Perform 24-hour Performance Test described in Article 3.3 after installation of stabilizing/solidification equipment. Sludge from lagoon 7 will be used for this test.

- D. Schedule work to provide steady delivery of stabilized soil and sludge to on-Site landfill for placement.
- E. Do not commence excavation and stabilization activities prior to USEPA and ENGINEER approval of submittals identified in Article 1.7 of this Section.

PART 2 PRODUCTS

2.1 STABILIZATION ADDITIVES

- A. Portland cement complying with ASTM C150, Normal Type 1.
- B. Lime kiln dust: Pozzalime (LKD) as supplied by J.T.M. Industries, Inc. of Beaver Creek, Ohio.
- C. Other additives as selected by CONTRACTOR and approved by ENGINEER including but not limited to calcined gypsum, lime, sand.

2.2 SUMPS

- A. Weighted, perforated, filter-cloth-wrapped, 55-gallon drums.

2.3 EQUIPMENT

- A. Capable of mixing and stabilizing sludges and soils.
- B. Capable of excavating sludge and soils as specified.

2.4 MIXES

- A. Stabilization Mix Designs:
 - 1. Following lagoon dewatering, incorporate stabilization additives into existing sludges and soils at mix ratio of stabilization additives to sludges or soils in accordance with approved mix design.
 - 2. Proportion stabilization additives to comply with Article 1.6.
 - 3. Proportion of stabilization additives to sludge following dewatering of work area may be modified as necessary based on field test results subject to compliance with Article 1.6.
 - 4. Modifications to mix design to meet performance criteria shall not be basis for change to Contract Price.

2.5 SOURCE QUALITY CONTROL

- A. Section 01400 - Quality Control: Requirements for source testing and analysis of lime kiln dust ash, Portland cement and other additives.

- B. Portland cement shall meet requirements of ASTM C150.
- C. Lime kiln dust shall meet requirements of Paragraph 2.1 B.
- D. Other additives shall meet specifications cited in Stabilization Plan.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01015 - General Requirements: Verification of existing conditions before starting work.
- B. Verify that on-Site landfill and Wastewater Treatment Facility are ready to receive waste and are operational.
- C. Verify that surfaces and Site conditions are ready to receive work and that vegetation (shrubs and trees) to be removed has been grubbed and disposed of as directed by ENGINEER.
- D. Verify that Site preparation activities as described in Section 02100 have been completed.

3.2 DEWATERING

- A. Provide pumps, piping, hoses, screens, fittings, valves, sumps, and appurtenances and dewater work area. Provide full-time supervision of dewatering operations.
- B. Equip pump suctions with floatation devices, screens, and/or place within sumps to prevent removal of debris and sediment or sludge from work area.
- C. Discharge any remaining standing and free water from work area to on-Site wastewater treatment plants. Advise ENGINEER minimum of 72 hours in advance of initiation of dewatering and discharge activities.
- D. Place sumps within work area to collect additional liquids and accumulated precipitation. Discharge collected liquids to on-Site wastewater treatment plant.
- E. Operate sumps continuously until standing and free water has been removed from work area. Maintain operation of each sump in each work area to remove free water which accumulates in sump until sump is removed to allow stabilization to proceed in that area. Do not remove sumps from operation without approval of ENGINEER.
- F. Maintain work area in a dry state until confirmatory testing is completed in accordance with Section 02750 and area is approved by ENGINEER for backfilling.

3.3 STABILIZATION SYSTEM PERFORMANCE TEST

- A. After dewatering of lagoons and installation and shake down of the stabilization equipment, perform a 24-hour System Performance Test.

- B. The 24-hour System Performance Test shall include the following items:
1. The test sludge shall be taken from lagoon No. 1 South.
 2. Three sets of stabilized sludge samples shall be collected at 8-hour intervals during the test.
 3. The following tests shall be conducted on each of the sample sets:
 1. TCLP volatiles (28 days after stabilization).
 2. Paint filter test (SW-846 9095).
 3. Triaxial compressive strength (ASTM D2850) for soil-like samples or unconfined, compressive strength (ASTM 2166) for cementitious samples at intervals of 1, 2, 3, 7, 14, and 28 days.
 4. A stack test from the in-vessel stabilization equipment using USEPA Methods 5 and 25, as noted in Appendix B, shall be conducted.
- C. No later than 30 days after completion of a successful system performance test, as determined by the USEPA and the Toledo Division of Environmental Services, prepare and submit to the ENGINEER a report summarizing the results of the system performance test. The ENGINEER will provide comments to the CONTRACTOR within 5 calendar days of receipt of the system performance test report. The CONTRACTOR shall then revise the system performance test report and, upon approval of the ENGINEER, submit the system performance test report to the USEPA and Toledo Division of Environmental Services via overnight delivery.
- D. *The system performance test report shall contain the results of the tests specified in Articles 3.3 B.3 and 3.3 B.4 of this Section and shall describe the methods, materials, procedures and equipment used to conduct the test. The system performance test report shall compare the test results of the stabilized material and air sampling to the performance criteria.*
1. The system performance test report shall be prepared in a manner that is acceptable to the ENGINEER and approvable by the USEPA and the Toledo Division of Environmental Services. The system performance test report shall demonstrate in a clear, concise and unambiguous manner, as determined by the USEPA and the Toledo Division of Environmental Services, that the performance requirements identified in Article 1.6 have been met during the system performance test.
- E. In the event that the USEPA and/or Toledo Division of Environmental Services provide comments regarding the system performance test report, revise and, upon approval of the ENGINEER, resubmit the system performance test report via overnight delivery to the USEPA and Toledo Division of Environmental Services within 7 calendar days of receipt of comments.
- F. Should the performance test fail to meet the performance requirements, the performance test shall be repeated at the CONTRACTOR's sole cost.
- G. Production operation of the stabilization equipment and stabilization of sludge or soil will not proceed until results of the stabilization system performance test have been approved by ENGINEER, USEPA and the Toledo Division of Environmental Services. Interim operation of the stabilization system (i.e., at a rate less than that proposed for production operation) may proceed

if the results of the stack test show that air emissions are within allowable limits and such interim operations are approved by the USEPA and the Toledo Division of Environmental Services.

3.4 STABILIZATION

- A. Preparing and Mixing Soils, Sludges, and Compatible Drummed Waste: Following dewatering of the work area and completion of compatibility testing, prepare and mix sludges with stabilization additives in accordance with CONTRACTOR's approved mix design using suitable equipment capable of producing consistent waste mixture.
- B. Sampling and Testing for Stabilization Confirmation: Collect and analyze samples of stabilized sludges to confirm adequate stabilization. Collect and analyze a minimum of 1 sample every 24 hours for unconfined or triaxial compressive strength and paint filter test in accordance with Article 3.8. If mixed sludges or soils do not meet performance criteria as specified in Article 1.6, modify mix design and remix materials until performance criteria are met. Supply of additional stabilization additives and all costs associated with additional stabilization required to meet performance criteria will be at CONTRACTOR's expense. Modifications to mix design will not be basis for change to Contract Price.

3.5 SLUDGE AND SOIL EXCAVATION

- A. Protect existing utilities, sewers, and structures from damage.
- B. Excavate to lines, grades, elevations, and dimensions shown on Drawings or as directed by ENGINEER.
- C. Transfer excavated and stabilized material to designated fill area of on-Site landfill or as directed by ENGINEER.
- D. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- E. Maintain clean areas isolated and in dewatered state until confirmatory testing has been completed and area is approved by ENGINEER for backfilling.
- F. Excavate additional bank soils and bottom clay as directed by ENGINEER if tests show not all contaminated material has been removed.
- G. Remove debris and other obstructions encountered.
- H. Notify ENGINEER of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
- I. Stockpile excavated clean material approved for reuse in area designated on Site in accordance with Section 02205.
- J. Hand trim, make firm, and remove loose material and debris from excavations. Where natural or fill material at bottom of excavation is disturbed, compact disturbed soil to density at least equal to undisturbed soil or to density specified for succeeding layer of backfill, whichever is greater, or remove disturbed soil and refill and compact space as directed by ENGINEER.

- K. Open excavations shall be CONTRACTOR's sole responsibility.

3.6 SEQUENCE OF OPERATIONS

- A. Following is general construction sequence for dewatering, removal, stabilization and placement of sludges and soils in the 7 lagoons which shall form basis for Detailed Landfill Development Plan.

1. Mobilize, setup and shakedown of wastewater treatment equipment.
2. Dewater all lagoons, removing standing water and free liquids.
3. Mobilize, setup and shakedown stabilization equipment.
4. Pump or otherwise remove sludges from lagoon 2 and place in lagoons 1-north or 6 as desired. Remove all visually contaminated soil from lagoons. Remove additional 6 inches of soil from lagoon bottoms and sides. Allow collection of confirmatory soil samples by ENGINEER. Analyze confirmatory samples collected by ENGINEER in accordance with Section 02750. Remove additional soil as directed by the ENGINEER.
5. Begin construction of western cell of the landfill.
6. Conduct 24-hour system performance test.
7. Commence dewatering, excavation and stabilization of contaminated sludge in south side of lagoon 1, and the removal to Staging Area A. Dispose of water from dewatering process at wastewater treatment facility, in accordance with Section 02757. Excavate visually clean soil and an additional 6 inches of soil as shown on Drawings or as directed by ENGINEER.
8. As lagoon 1-south is cleared, allow confirmatory sample collection by ENGINEER. Analyze confirmatory soil samples collected by ENGINEER in accordance with Section 02750. Remove additional soil as directed by ENGINEER.
9. Continue construction of landfill toward west in lagoon 1 as authorized by ENGINEER.
10. Upon completion of landfill base, commence removal and final stabilization of partially stabilized sludges from eastern cell of landfill, placement and compaction in on-Site landfill.
11. Place and compact stabilized sludges from staging areas.
12. Allow confirmatory sample collection by ENGINEER in emptied lagoon bases.

- B. Upon completion of sludge and visually contaminated soil (and additional 6 inches) removal in any portion of lagoons, provide ENGINEER with 48-hour period to obtain confirmatory soil samples of base. Analyze samples collected by ENGINEER in accordance with Section 02750. Maintain area in dry condition pending approval by ENGINEER.

- C. Excavate and remove to on-Site Landfill contaminated soils not requiring stabilization as directed by ENGINEER as provided in Section 02222.

3.7 TRANSPORTATION AND PLACEMENT OF STABILIZED MATERIALS AT ON-SITE LANDFILL

- A. Section 02222 - Excavating - requirements for Detailed Landfill Development Plan.
- B. Place stabilized materials in on-Site landfill in accordance with approved Detailed Landfill Development Plan.
- C. Compact stabilized materials at on-Site landfill to 90 percent Standard Proctor Density or to density cited in ENGINEER-approved Detailed Stabilization Plan.

3.8 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Control: Field inspection and testing.
- B. Mix stabilization additives with soil or sludge to achieve homogeneous damp mixture without lumping, yet not creating wet plastic consistency.
- C. Methods of Testing:
 - 1. Compressive strength shall be determined in accordance with ASTM D2850 for soil-like samples and ASTM D2166 for cementitious samples.
 - 2. Paint filter test shall be conducted in accordance with SW-846 Method 9095.
 - 3. TCLP test shall be conducted in accordance with SW-846 Methods 1311 and 8240.
 - 4. Modified Proctor Density shall be conducted in accordance with ASTM D1557.
- D. Testing by CONTRACTOR for stabilized materials:

<i>Parameter</i>	<i>Method</i>	<i>Frequency</i>
Triaxial Compressive Strength (for soil-like samples) or Unconfined Compressive Strength (for cementitious samples)	ASTM D2850 ASTM D2166	daily, as required prior to transport to landfill daily, as required prior to transport to landfill
Free Liquid (paint filter)	SW-846 9095	daily, as required prior to transport to landfill
Modified Proctor Density	ASTM D1557	once per source area
TCLP	SW-846 1311 and 8240	once per source area

- E. Test confirmatory soil samples collected by ENGINEER in accordance with Section 02750 to determine if contaminants have been removed.
- F. ENGINEER will check consistency of stabilization additives and sludge mixes.
- G. ENGINEER will confirm that Works are kept dry.
- H. Test compaction of stabilized sediments, sediments, and stabilized sludges at on-Site landfill using appropriate ASTM methods as noted in Paragraph 3.3 B.3.3 at frequency of 1 per lift.

3.9 CLEANING

- A. Section 01700 - Contract Closeout: Requirements for cleaning installed work.
- B. Remove equipment, and surplus raw materials.

END OF SECTION

SECTION 02243

GEOTEXTILE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Geotextile.

1.2 RELATED SECTIONS

- A. Section 02223 - Backfilling.
- B. Section 02275 - Riprap.

1.3 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. ASTM D3776 - Standard Test Methods for Mass Per Unit Area (Weight) of Woven Fabric.
- C. ASTM D3786 - Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics-Diaphragm Bursting Strength Tester Method.
- D. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
- E. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
- F. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile.
- G. ASTM D4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products.

1.4 DEFINITIONS

- A. Geotextile: Synthetic fiber filter fabric for use in geotechnical filter applications or erosion control applications.

1.5 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Product Data: Include installation, handling, storage, and repair instructions. Submit 14 days prior to installation.

- C. **Samples:** Furnish a representative sample of geotextile at least 3 feet by 3 feet in size with manufacturer's chemical and physical analysis.
- D. **Test Reports:** Include material properties sheets and quality control certificates. Submit at least 14 days prior to installation.
- E. **Manufacturer's Certificates:** Certify that geotextile meets or exceeds specified requirements. Certify minimum average roll property values of the proposed geotextiles and the test used to determine those properties.
- F. **Quality Control Certificates:**
 - 1. Certificates for each batch of fiber and each shift's production. The certificates shall identify the origin of the fiber and manufacturer of the fiber.
 - 2. Certificates for each shift's production. The certificates shall include the following:
 - 1. Roll numbers and identification.
 - 2. Sampling procedures.
 - 3. Results of quality control tests, including descriptions of test methods used. Geotextile manufacturer quality control tests to be performed are specified in PART 2.
 - 3. The certificates shall be signed by responsible parties employed by manufacturer, such as the production manager.
- G. **Warranties:** Completed original warranty forms filled out in TRUST's name and registered with manufacturer.

1.6 QUALIFICATIONS

- A. **Manufacturer:** Company specializing in manufacturing the products specified in this Section with minimum 3 years documented experience.
- B. **Installer:** Company specializing in performing the work of this Section with minimum 3 years documented experience.

1.7 PRE-INSTALLATION MEETING

- A. **Section 01015 - General Requirements:** Requirements for pre-installation meeting.
- B. Convene 1 week prior to commencing work of this Section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Material and Equipment: Requirements for transporting, handling, storing, and protecting products.**
- B. Deliver geotextile bearing manufacturer's seals and labels intact. Clearly label each roll to show geotextile identification, date of manufacture, lot number, analysis of contents, and special instructions.**
- C. Store and handle geotextile in accordance with manufacturer's recommendations, indoors, in manufacturer's original covers, and protect from moisture, dust, light, and heat.**
- D. Upon arrival at Site inspect, with ENGINEER, materials for defects in the manufacturing process and for damage during transportation. Reject materials judged by ENGINEER to be severely damaged and remove from Site. Repair minor damage and other defects.**

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Section 01500 - Construction Facilities and Temporary Controls: Requirements for temporary controls.**
- B. Install geotextile in dry conditions and in accordance with manufacturer's instructions.**
- C. Suspend installation operations whenever climatic conditions, as determined by ENGINEER, are unsatisfactory for placing geotextile to the requirements of this Section.**

1.10 SEQUENCING AND SCHEDULING

- A. Section 01015 - General Requirements: Requirements for coordination.**
- B. Coordinate installation of geotextile with surface preparation work and installation of structures which will penetrate liner.**
- C. Unless otherwise specified, do not commence geotextile installation before surfaces are properly prepared and structures which will penetrate liner are installed.**
- D. Coordinate installation of geotextile with installation of riprap in accordance with Section 02275.**

1.11 WARRANTY

- A. Section 01300 - Submittals: Requirements for warranties.**
- B. Provide manufacturer's warranty for geotextile.**
- C. Warranty: Include coverage for installation of geotextile.**

- D. Correct defective Works within a 5-year period after the date of Preliminary Acceptance of Works.
- E. Fill out original warranty forms in TRUST's name and register with manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Amoco Fabrics and Fibers Co.

2.2 GEOTEXTILE

- A. Rot-proof and not subject to attack by insects or rodents.
- B. 100 percent polypropylene combining high modulus, high permeability, and strength.
- C. Capable of retaining its structure during handling, placement, and long-term service.
- D. Capable of withstanding direct exposure to sunlight for a minimum of 30 days with no measurable deterioration.
- E. Complying with the specifications listed in Article 2.3.

2.3 SOURCE QUALITY CONTROL

- A. Section 01400 - Quality Control: Requirements for source testing and analysis of geotextile.
- B. Manufacturer Quality Control:
 - 1. Sample and test geotextile material, at a minimum, once every 40,000 sq ft to demonstrate that the material conforms to requirements specified in Paragraphs 2.3 C and 2.3 D.
 - 2. Sampling shall, in general, be performed on sacrificial portions of the material such that repair of the material is not required.
 - 3. If geotextile sample fails to meet the quality control requirements of this Section, sample and test each roll manufactured in the same lot, or at the same time, as the failing roll. Sampling and testing of rolls shall continue until a pattern of acceptable test results is established.
 - 4. At geotextile manufacturer's discretion and expense, additional testing of individual rolls may be performed to more closely identify the non-complying rolls and/or to qualify individual rolls.
- C. Geotextile Type G-1: Nonwoven needle punched 4508, any roll in a lot shall meet or exceed the following values:

<i>Test</i>	<i>Unit</i>	<i>Test Method</i>	<i>Minimum Average Roll Value</i>
Unit Weight	ounces per sq yd	ASTM D3776	8
Tensile Strength	pounds	ASTM D4632	200
Elongation at Break	percent	ASTM D4632	50
Mullen Burst Strength	psi	ASTM D3786	450
Puncture Strength	pounds	ASTM D4833	130
Coefficient of Permeability	cm/s	ASTM D4491	0.2
Apparent Opening Size (AOS)	sieve size	ASTM D4751	100

D. Geotextile Type G-2: Woven 2006, any roll in a lot shall meet or exceed the following values:

<i>Test</i>	<i>Unit</i>	<i>Test Method</i>	<i>Minimum Average Roll Value</i>
Tensile Strength	pounds	ASTM D4632	300
Grab Tensile Elongation	percent	ASTM D4632	15
Mullen Burst Strength	psi	ASTM D3786	600
Puncture Strength	pounds	ASTM D4833	120
Apparent Opening Size (AOS)	sieve size	ASTM D4751	40

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01015 - General Requirements: Verification of existing conditions before starting work.
- B. Verify that surfaces and Site conditions are ready to receive work.

3.2 PREPARATION

- A. Prior to geotextile placement, where possible roll the surface with a smooth drum steel or pneumatic roller so as to be free of irregularities, loose earth, and abrupt changes in grade. Provide the necessary equipment and personnel to maintain an acceptable supporting surface during fabric installation.

- B. Examine geotextile for defects including rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, or handling.
- C. Remove defective or damaged geotextile.

3.3 INSTALLATION

- A. Notify ENGINEER at least 24 hours in advance of intention to commence placement of geotextile.
- B. Do not permit placement of overlay materials until ENGINEER has inspected and approved installation of geotextile.
- C. Obtain approval of ENGINEER prior to installation of geotextile.
- D. Place the geotextile on a prepared base as shown on Drawings.
- E. Unfold or unroll geotextile in accordance with manufacturer's instructions, directly on the prepared base, in conditions which will prevent damage to both the geotextile and the base grade. Unsuitable conditions include, but are not limited to moderate to high wind conditions.
- F. Overlap dimensions and the method of joining adjacent sheets shall be in strict conformance with manufacturer's instructions. Secure geotextile to the base grade in accordance with manufacturer's instructions and as shown on Drawings.
- G. During placement of geotextile, do not entrap stones in the geotextile.
- H. Unless specially selected for their ultraviolet light resistance, do not expose geotextiles to sunlight for more than 30 days, or as recommended by manufacturer.
- I. Position and deploy geotextile to minimize handling. Lay smooth and free of tension, stress, folds, or creases. Protect properly placed geotextile from displacement, contamination by surface runoff, or damage, until and during placement of overlaid materials.
- J. Place geotextile on sloping surfaces in one continuous length.
- K. Do not permit passage of vehicular traffic directly on geotextile at any time.
- L. Place geotextile by unrolling onto graded surface and retain in position as specified.
- M. Remove and replace damaged or deteriorated geotextile as directed by ENGINEER.

3.4 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Control: Field inspection.

- B. ENGINEER will inspect geotextile in place for tears, overlaps, and consistency before placing materials thereon. Damaged sections, as judged by ENGINEER, will be marked and their removal from the work area recorded.
- C. ENGINEER will verify that weather conditions (air temperature, non-excessive wind, and lack of precipitation) are acceptable for placement.

END OF SECTION

SECTION 02247

HDPE LINER

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Textured HDPE liner for containment cell cap.

1.2 RELATED SECTIONS

- A. Section 02223 - Backfilling.

1.3 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. American Society for Testing and Materials (ASTM):
 - 1. D638 - Standard Test Method for Tensile Properties of Plastics.
 - 2. D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 3. D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
 - 4. D1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
 - 5. D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique.
 - 6. D1603 - Standard Test Method for Carbon Black in Olefin Plastics.
 - 7. D5199 - Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes.
- C. Geosynthetic Research Institute (GRI): Test Method GM9 - Standard Practice for Cold Weather Seaming on Seamembranes.
- D. National Sanitation Foundation (NSF): 54 - Flexible Membrane Liners.

1.4 DEFINITIONS

- A. HDPE: High density polyethylene.

- B. SMDD: Standard Maximum Dry Density and in the context of this Contract means the maximum dry unit weight determined in accordance with ASTM D698.
- C. Wrinkles: Corrugations in HDPE liner which will fold over during placement of materials overlying HDPE liner.

1.5 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Product Data: Include installation, handling, storage, and repair instructions. Submit 14 days prior to installation.
- C. Layout Drawings: Drawings of the proposed HDPE liner placement pattern and seams prior to HDPE liner placement. Indicate the panel configuration and location of seams. Differentiate field seams from factory seams (if any).
- D. Test Reports: Include material properties sheets and quality control certificates. Submit at least 14 days prior to fabrication or installation if there is no fabrication.
- E. Material Properties: Include data regarding chemical compatibility of HDPE liner with contacting fluids. The allowable range in values of properties listed in the sheet shall meet the specific requirements. The sheet shall provide minimum properties guaranteed by HDPE liner manufacturer and indicate test methods used.
- F. Quality Control Certificates:
 - 1. Certificates pertaining to the rolls of HDPE material delivered to Site shall accompany the rolls. Each roll shall be identified by a unique manufacturing number. The quality control certificate shall include results of at least the following tests: density, carbon black content, thickness, tensile characteristics, puncture resistance, tear resistance, and low temperature brittleness. The quality control certificates shall be signed by a responsible party employed by HDPE liner manufacturer, such as production manager, and shall be notarized.
 - 2. Provide certificates pertaining to raw materials and manufactured HDPE liner rolls from HDPE liner manufacturer. ENGINEER will review test results for completeness and for compliance with the required minimum properties for both raw materials and manufactured HDPE liner rolls. Materials and rolls which are in non-compliance with the minimum required properties will be rejected.
- G. Daily Field Installation Report: Include:
 - 1. Total amount and location of HDPE liner placed.
 - 2. Identifiers of rolls and fabricated blankets.
 - 3. Quality control tests of materials used during the day.
 - 4. Total amount and location of seams completed and seamer and units used.
 - 5. Changes in layout drawings.

6. Results of test seams.
7. Location and results of non-destructive testing.
8. Location and results of destructive testing.
9. Location of repairs and results of retesting.
10. Record daily activities of HDPE liner installation, including, but not limited to, the following observations:
 1. HDPE liner placement activities and record of defects caused during transportation and handling.
 2. Test seams including seaming unit number and identification of names of seamers, weather conditions, and results.
 3. Anchor trench excavation, backfilling, and compaction.
 4. Field seaming operations including weather conditions, cleaning, overlaps, rate of seaming, names of seamers, and units used.
 5. Seams around appurtenances and connection to appurtenances.
 6. Destructive and non-destructive seam testing including testing location, location of defects, and testing unit used.
 7. Repairs and retesting including locations, name of repairer, and seaming equipment or products used.

H. Warranties: Completed original warranty forms filled out in TRUST's name and registered with manufacturer.

1.6 QUALIFICATIONS

A. Installer:

1. Trained and qualified to install the type of HDPE liner to be used for the project, and an approved and/or licensed installer of HDPE liner manufacturer. Submit a copy of the approval letter or license.
2. Demonstrate an ability to install HDPE liner by providing a list of at least 3 previous HDPE liner installations, totaling a minimum of 10 million sq ft, completed with the same generic type of HDPE liner. For each installation provide the following information: name of project, location, date, name of owner, designer, manufacturer, and installer, purpose of HDPE liner, type of HDPE liner, thickness, total amount of HDPE liner installed, type of seaming, and available written information on the performance of HDPE liner.

B. Seamer:

1. Personnel performing seaming operations shall be qualified by experience or by successfully passing seaming tests.
2. At least 1 seamer shall have experience seaming at least 10 million sq ft of HDPE liner of the same generic type as HDPE liner used for the project using the same type of seaming method. This master seamer shall provide direct supervision over apprentice seamers.

C. Apprentice seamers shall be qualified by attending training sessions taught by the master seamer and performing at least 2 successful seaming tests under similar weather conditions using the seaming method used for production seaming.

1.7 PRE-INSTALLATION MEETING

A. Section 01015 - General Requirements: Requirements for pre-installation meeting.

B. Convene 1 week prior to commencing work of this Section.

C. Purpose of Meeting:

1. Define the responsibilities of each party.
2. Establish lines of authority and lines of communication.
3. Establish Site-specific quality control and monitoring procedures.
4. Define the method of acceptance of the completed liner.
5. Establish rules for writing on the liner (i.e., who is authorized to mark on the liner and in what colors).
6. Review time schedules.
7. Review dress codes and applicable regulations.
8. Review safety plan and procedures.
9. Review panel layout and numbering system for panels, seams, and test samples.
10. Review methods of measuring production.
11. Review procedures for incremental acceptance.
12. Review procedures for initiating and implementing change orders.
13. Visit Site for review of surface preparation, physical location of Site, and Site access.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Material and Equipment: Requirements for transporting, handling, storing, and protecting products.
- B. Package and label HDPE liner rolls or blankets prior to shipment to Site. The label shall indicate HDPE liner manufacturer, type of HDPE liner, thickness, lot number, roll number, and roll dimensions.
- C. When transported to Site, handle HDPE liner rolls or blankets by appropriate means so that no damage is caused, as recommended by HDPE liner manufacturer.
- D. Protect HDPE liner from direct sunlight and heat to prevent degradation of HDPE liner material and adhesion of individual whorls of a roll or layers of blanket.
- E. Take adequate measures to keep HDPE liner materials away from possible deteriorating sources (i.e., vandalism, theft).
- F. Use appropriate handling equipment when moving rolled or folded HDPE liner from one place to another.
- G. Upon arrival at Site inspect, with ENGINEER, materials for defects in the manufacturing process and for damage during transportation. Reject materials judged by ENGINEER to be severely damaged and remove from Site. Repair minor damage and other defects.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Section 01500 - Construction Facilities and Temporary Controls: Requirements for temporary controls.
- B. Install liner in dry conditions and in accordance with manufacturer's instructions.
- C. Suspend installation operations whenever climatic conditions, as determined by ENGINEER, are unsatisfactory for placing liner to the requirements of this Section.
- D. *Weather Conditions for HDPE Liner Placement:*
 - 1. Comply with manufacturer's recommendation.
 - 2. Do not unroll, unfold, or place HDPE liner at an ambient temperature below 41 degrees F or above 104 degrees F, unless CONTRACTOR obtains written approval from HDPE liner manufacturer and ENGINEER.
 - 3. HDPE liner placement shall take into account Site drainage, wind direction, landfill cap construction, access to Site and production schedule of project.
 - 4. HDPE liner placement shall not proceed if subgrade conditions have deteriorated due to moisture, or in the presence of high winds which might damage the HDPE liner.
 - 6. Deployed HDPE liner should be adequately ballasted at all times to limit the risk of wind damage.

E. Weather Conditions for HDPE Liner Seaming:

1. Comply with manufacturer's recommendations.
2. Make no weld below 34 degrees F unless:
 1. CONTRACTOR strictly follows the guidelines for the field seaming of HDPE liner in cold weather, as identified in GRI Test Method GM9.
 2. CONTRACTOR obtains written approval from HDPE liner manufacturer to weld at temperature below 32 degrees F in accordance with GRI Test Method GM9.
3. Between 32 degrees F and 50 degrees F, seaming is possible if HDPE liner is preheated by either sun or hot air device, and if there is not excessive cooling resulting from wind.
4. Make no weld below 5 degrees F.
5. In all cases, HDPE liner must be dry.

1.10 SEQUENCING AND SCHEDULING

- A. Section 01015 - General Requirements: Requirements for coordination.
- B. Coordinate the installation of HDPE liner with surface preparation work and installation of structures which will penetrate the liner.

1.11 WARRANTY

- A. Section 01300 - Submittals: Requirements for warranties.
- B. Provide 20-year manufacturer's material warranty and 2-year workmanship warranty for HDPE liner.
- C. Correct defective Works within a 2-year period after the date of Preliminary Acceptance of Works.
- D. Fill out original warranty forms in TRUST's name and register with manufacturer.

PART 2 PRODUCTS

2.1 TEXTURED HDPE LINER

- A. Manufacturer: GSE Lining Technology, Inc.; GSE HD Textured.
- B. Manufactured of first quality newly produced raw materials. The use of reclaimed polymers and other materials will not be permitted. Recycling of materials containing reinforcing scrim will not be permitted. Recycling scrap that does not contain scrim may be permitted.

- C. Design and manufacture rolls specifically for the purpose of fluid containment.
- D. Free of holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.
- E. Complying with the specifications listed in Paragraph 2.3 C.

2.2 SOURCE QUALITY CONTROL

- A. Section 01400 - Quality Control: Requirements for source testing and analysis of textured HDPE liner.
- B. Textured HDPE Liner: Conform to typical and minimum average roll values listed as follows:

<i>Property</i>	<i>Unit</i>	<i>Test Method</i>	<i>Typical Value</i>	<i>Minimum Average Roll Value (MARV)</i>
Thickness	mils	ASTM D5199	40	40
Density	g/cu cm	ASTM D1505	0.946	0.940
Tensile Strength at Yield	pounds per inch width	ASTM D638 Type IV, 2 ipm Gate lengths per NSF 54	92	86
Tensile Strength at Break	pounds per inch width	ASTM D638 Type IV, 2 ipm Gate lengths per NSF 54	50	50
Elongation at Yield	percent	ASTM D638 Type IV, 2 ipm Gate lengths per NSF 54	13	13
Elongation at Break	percent	ASTM D638 Type IV, 2 ipm Gate lengths per NSF 54	150	120
Low Temperature Brittleness	degrees F	ASTM D746 Procedure B	minus 107	minus 94
Carbon Black Content	percent	ASTM D1603	2 to 3	2 to 3
Puncturing Resistance	pounds	FTMS 101B, Method 2065	52	52

Tear Resistance	pounds	ASTM D1004, Die C	30	30
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PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01015 - General Requirements: Verification of existing conditions before starting work.
- B. Obtain ENGINEER's approval prior to installing HDPE liner and prior to placing subsequent layers on HDPE liner.
- C. Coordinate activities such that ENGINEER can observe testing. ENGINEER will observe all testing and collect samples for destructive laboratory testing.

3.2 PREPARATION

- A. Surface Preparation:
 - 1. Do not begin installation of HDPE liner until a proper subbase has been prepared and approved by ENGINEER. The prepared surface shall be free from loose earth, exposed rocks larger than 3 inch diameter, rubble, protrusions, vegetation, and other foreign matter. Compact the subgrade uniformly to a minimum of 95 percent SMDD to ensure against settlement and rutting under wheel loads, and smooth with a drum or vibratory roller.
 - 2. Do not place HDPE liner in an area which has become softened by precipitation and which will not support liner installation equipment without rutting.
- B. Panel Preparation: Prior to seaming, clean the seam area and ensure it is free of moisture, dust, dirt, debris of any kind, and foreign material.
- C. Seaming Equipment and Products: Seam HDPE liner using extrusion or hot wedge welding equipment and installation methods recommended by manufacturer. Extrusion welding equipment shall include thermometers giving the temperature of the extrudate in the machine and at the nozzle. Where extrusion welding is used, the composition of the extrudate shall be identical to the liner material, or all panels shall be welded together using the hot wedge welding system. Wedge welding equipment used shall be capable of continuously monitoring and controlling the temperatures in the zone of contact where the machine is actually fusing the liner material so as to ensure that changes in environmental conditions will not affect the integrity of the weld.

3.3 PANEL PLACEMENT

- A. Redesignate each roll or blanket with a panel number. A panel is the unit area of in-place membrane which is to be seamed (i.e., 1 roll may be cut into several panels). Position HDPE liner on Site as shown on the layout drawings. Follow instructions on the wrapping containing HDPE liner materials to assure the panels are unrolled or unfolded in the proper direction for seaming. Unroll or unfold only the panels which are to be anchored or seamed together that day. Exercise

care not to damage HDPE liner during this operation. Require workers to wear shoes which will not damage HDPE liner.

- B. Minimize pulling of HDPE liner panels to reduce permanent tension.
- C. Take the following precautions to minimize the risk of damage by wind during panel placement:
 - 1. Orientate work according to the direction of prevailing winds if possible, unless otherwise specified.
 - 2. Provide adequate securement of HDPE liner panels to prevent uplift by wind, using sand bags, tires, or any other means which will not damage HDPE liner. Along the edges, ensure loading is continuous, to avoid possible windflow under the panels.
- D. Replace panels which, in the judgment of ENGINEER, become seriously damaged (torn or twisted permanently). Repair less serious damage in accordance with Article 3.7.
- E. Do not proceed with HDPE liner placement when raining or in an area of ponded water.
- F. Install HDPE roll so that there will be no tension or wrinkles at the average expected temperature of the final use condition.

3.4 INSTALLATION AROUND APPURTENANCES

- A. Install HDPE liner around wells, vents, or other appurtenances protruding through HDPE liner as shown on Drawings. Unless otherwise specified, initially install HDPE liner sleeve or shield around each appurtenance prior to the areal HDPE liner installation. After HDPE liner has been placed and seamed, complete the final field seam connection between the appurtenance sleeve or shield and the HDPE liner. Maintain a sufficient initial overlap of the appurtenance sleeve so that shifts in location of HDPE liner can be accommodated.
- B. Perform installation on rough surfaces carefully to minimize HDPE liner damage. Additional loosely placed HDPE liner sections may be used by HDPE liner installer as protection for HDPE liner, if approved by ENGINEER.

3.5 FIELD SEAMING

- A. The direction of seaming on slopes shall be such that the flow of water over top of HDPE liner is not hindered. Specifically, HDPE liner overlap shall be on the downgradient side of the seam. Extend seaming to the outside edge of panels to be placed in the anchor trench.
- B. If the supporting soil is soft, provide a firm substrate by using a homogeneous board, a conveyor or belt, or similar hard surface directly under the seam overlap to effect proper rolling pressure.
- C. Seaming Wrinkles: Cut fishmouths and wrinkles so as to effect a flat overlap. Seam the cut fishmouths or wrinkles as well as possible, and then patch with an oval or round patch of the same generic HDPE liner extending a minimum of 6 inches beyond the cut in all directions.

3.6 OVERLAPPING

- A. Overlap the panels a minimum of 4 inches for extrusion welds and a minimum of 5 inches for hot wedge welds.

3.7 REPAIR PROCEDURES

- A. Clean and dry surfaces at the time of repair.
- B. Abrade surfaces as appropriate.
- C. Repair pinholes and defective seams by reseaming or applying a patch.
- D. Repair tears, blisters, larger holes, undispersed raw materials, and contamination by foreign matter, by patches.
- E. Patches:
 - 1. Number each patch.
 - 2. Ensure patches are round or oval in shape.
 - 3. Make of the same generic HDPE liner.
 - 4. Extend a minimum of 6 inches beyond the edge of defects.

3.8 INSTALLATION OF MATERIALS IN CONTACT WITH HDPE LINER

- A. Place bedding and cover material in a manner so as not to damage HDPE liner.

3.9 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Control: Field inspection and testing.
- B. Inspect each panel after placement and prior to seaming for damage caused by placement operations or by wind. Mark damaged panels or portions of damaged panels which have been rejected, as judged by ENGINEER, and record their removal from the work area.
- C. Verify that weather conditions (air temperature, non-excessive wind, and lack of precipitation) are acceptable for panel placement.
- D. Field Seaming Operations: Verify that:
 - 1. Seaming personnel have the specified qualifications.
 - 2. Overlaps meet specified requirements.
 - 3. Seaming area is clean, as specified.

4. A hard substrate such as a board or a piece of conveyor belt is used if the supporting soil is soft.
5. Seaming equipment is available and meets specified requirements.
6. Weather conditions for seaming are acceptable, as specified.
7. Seaming procedures as specified are followed.
8. Panels are properly positioned to minimize undulations and prevent wrinkling.
9. Equipment for testing seams is available on Site.

E. Test Seams:

1. Perform test seams to verify the seaming conditions are adequate. Conduct test seams at the discretion of ENGINEER and at least 2 times each day (at the beginning of the day and at least 4 hours thereafter) for each seaming equipment or adhesive product used that day. Also, each seamer shall perform at least 1 test seam each day. Perform test seaming under the same conditions as production seaming. Extrusion weld test seams shall be at least 4 feet long. Hot wedge weld test seams shall be at least 10 feet long.
2. Cut 1-inch wide coupons from the test seam. Test coupons in shear and peel using a calibrated field tensiometer.
 1. Minimum strength of HDPE liner test seams when tested in shear shall be 95 percent of the specified tensile strength (MARV) at yield of the unseamed HDPE liner.
 2. Minimum strength of HDPE liner test seams when tested in peel shall be 60 percent of the specified tensile strength (MARV) at yield of the unseamed HDPE liner.
 3. In addition, the test coupons must not delaminate. Passing test results must be obtained of 4 of 5 coupons when tested in shear, and 4 of 5 coupons when tested in peel. For HDPE liner test seams performed using a hot wedge welder, perform peel tests on both the inside and outside welds; both welds must pass the peel test. If a test seam fails, reject the seaming equipment or product and do not use for production seaming until the deficiencies are corrected and a successful test seam is produced.
3. A passing test seam will be an indicator of the adequacy of the seaming unit and seamer working under prevailing Site conditions, but not necessarily an indicator of seam adequacy.
4. Coordinate completion of test seams such that ENGINEER can observe such seams. ENGINEER will observe all test seams. Retain a sample from each test and label with the date, ambient temperature, number of seaming unit, seamer, and pass or fail description. One half of the sample will be retained by ENGINEER.

F. Non-destructive Seam Testing:

1. Non-destructively test field seams over their full length by vacuum box, pressure testing, or approved equal. Number or otherwise designate each seam. The location, date, test

unit, name of tester, and outcome of all non-destructive testing will be recorded by ENGINEER.

2. Passing non-destructive test of field seams indicates the adequacy of field seams, subject to the results of destructive seam testing, as identified in Paragraph 3.9 G.
3. Coordinate activities such that ENGINEER can observe all testing. ENGINEER will observe all testing. Conduct testing as the seaming work progresses, not at the completion of all field seaming. Number and mark all defects found during testing immediately after detection. Repair, retest, and remark all defects found to indicate completion of the repair and acceptability. If pressure testing is performed, following testing the hole resulting from the pressure needle must be repaired.

G. Destructive Seam Testing:

1. Destructively test samples of HDPE liner field seams at a frequency of approximately 1 sample per 500 linear feet of field seam, or more frequently if requested by ENGINEER, at locations indicated by ENGINEER. Field test 5 coupons in peel and 5 coupons in shear, using a calibrated field tensiometer. Perform peel tests only on the outside weld. If at least 4 of each of the 5 coupons do not delaminate and pass the tensile strength requirements, based on the field testing, then collect additional samples from the same location and provide to ENGINEER for quality assurance laboratory shear and peel testing. Minimum strength of HDPE liner field seams when tested in shear shall be 95 percent of the specified tensile strength (MARV) at yield of the unseamed HDPE liner for both the field and laboratory tests. Minimum strength of HDPE liner field seams when tested in peel shall be 62 percent of the specified tensile strength (MARV) at yield of the unseamed HDPE liner for both the field and laboratory tests. If either field or laboratory tests fail, isolate the defective seam and re-test as follows:
 1. Collect additional samples from the field seam for destructive testing using a field tensiometer, at locations on each side of the failing sample as determined by ENGINEER, until passing test locations are identified. Collect additional samples from each passing field test location and provide to ENGINEER for laboratory shear and peel testing.
 2. Repair the field seam between the passing test locations (based on field tensiometer results) by extrusion welding or using a patch.
 3. Non-destructively test the patch or extrusion weld and repair, as required, until the adequacy of the seam is achieved.
 4. If the additional laboratory shear or peel tests fail, then additional field samples will be collected and field tested to isolate the failing seam, then laboratory tested.
 5. Repeat the above-noted procedure until passing results are achieved based on the field and laboratory tests.

H. Verification of Seams in Special Locations:

1. Non-destructively test seams in special locations if the seam is accessible to testing equipment. If the seam cannot be tested in place, but is accessible to testing equipment prior to final installation, non-destructively test the seam prior to final installation

(e.g., seam around appurtenances). ENGINEER will observe all seam testing operations. If the seam cannot be tested in place, or prior to final installation, it will be observed by ENGINEER and Superintendent for uniformity and completeness.

2. Record the seam number, date of observation, name of tester, and outcome of the test or observation.
3. Promptly repair, retest, and re-mark defective seams to indicate completion of the repair.

I. Defects and Repairs:

1. Identification: Inspect seams and non-seam areas of HDPE liner for identification of defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.
2. Evaluation: Non-destructively test each suspect location, both in seam and non-seam, using the methods described in Paragraph 3.9 F. Mark and repair each location which fails the non-destructive testing.
3. Verification of Repairs: Non-destructively test each repair using the method described in Paragraph 3.9 F. Take tests which pass the non-destructive test as an indication of an adequate repair. Reseam and test failed tests locations until a passing test results. Record the number of each patch, date, location, patcher, and test outcome. ENGINEER will observe non-destructive testing of repairs.

J. HDPE Liner Acceptance:

1. HDPE liner will be accepted by ENGINEER when:
 1. Installation is finished.
 2. Documentation of installation is completed.
 3. Verification of the adequacy of field seams and repairs, and associated testing, is complete.

- K. Quality Assurance Testing by ENGINEER: Quality assurance laboratory engaged by TRUST will perform laboratory tests on HDPE liner samples as identified in this Section to determine if HDPE liner seams meet specified requirements. Copies of test reports will be supplied to CONTRACTOR on request. Retesting of previously failed HDPE liner seams will be at no additional cost to TRUST.

3.10 MANUFACTURER'S FIELD SERVICES

- A. Manufacturer shall provide a qualified representative to observe placement of HDPE liner, subgrade preparation, HDPE liner installation, and backfilling operations. Manufacturer's representative shall guide the installer into proper installation techniques but shall not assume liability or responsibility in the overall installation.
- B. Manufacturer's representative shall have extensive knowledge of HDPE liner product, specifically as it pertains to proper construction techniques for waste management applications.

- C. Manufacturer's representative shall remain on Site until, in his opinion, CONTRACTOR and/or installer can adequately complete the installation in strict accordance with specifications and the installation procedure specified in this Section.

3.11 PROTECTION OF FINISHED WORK

- A. Section 01500 - Construction Facilities and Temporary Controls: Requirements for protecting installed work.
- B. Protect finished work from damage.
- C. Do not permit traffic over unfinished liner installation.

END OF SECTION

SECTION 02275

RIPRAP

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Riprap.

1.2 RELATED SECTIONS

- A. Section 02207 - Supply of Aggregate Materials.
- B. Section 02223 - Backfilling.

1.3 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Source: Inform ENGINEER of proposed source of riprap at least 14 days prior to commencing production, including any change in material source during performance of Works.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Section 01500 - Construction Facilities and Temporary Controls: Requirements for temporary controls.
- B. Suspend operations whenever climatic conditions, as determined by ENGINEER, are *unsatisfactory for placing riprap to the requirements of this Section.*

PART 2 PRODUCTS

2.1 RIPRAP

- A. Unweathered, durable igneous, metamorphic, or sedimentary rock.
- B. Free from organic, mica, shale, or other unsuitable material.
- C. Individual Rock Fragments: Hard, dense, sound, and resistant to abrasion and free of cracks, seams, and other structural defects that would tend to increase unduly their destruction by water and frost action and handling.
- D. *Do not use rock exhibiting marked deterioration by water or weather.*

E. Rock size for riprap lining:

<i>Size</i>	<i>Percentage of Total Weight Smaller Than Given Size</i>
10 inches	100 percent
8 inches	85 percent
6 inches	50 percent
4 inches	15 percent

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01015 - General Requirements: Verification of existing conditions before starting work.
- B. Do not place riprap over frozen or spongy subgrade surfaces.

3.2 PLACEMENT

- A. Place geotextile fabric over substrate, lap edges, and ends.
- B. Place riprap by suitable methods to ensure minimum breakage of individual pieces during placing.
- C. Ensure riprap does not mix with or damage foundation material, including geotextile fabric.
- D. Place riprap in accordance with layer thicknesses and details shown on Drawings.
- E. Place riprap in an approved manner to secure the surface and to provide a stable mass.
- F. Uniformly distribute larger rock over the entire area and distribute the remainder uniformly with smaller pieces filling voids between larger pieces.
- G. Finish surfaces in such a manner so as to ensure they are stable, reasonably uniform, free from bumps or depressions, with no excessively large cavities below or individual rock pieces projecting above the general surface.
- H. Where riprap is to be placed on slopes, excavate a trench at toe of slope in accordance with dimensions shown on Drawings.
- I. Hand place riprap as follows:
 - 1. Use larger pieces in lower course and as headers for subsequent courses.
 - 2. Stagger vertical joints and fill voids with rock spalls or cobbles.
 - 3. Finish surface even, free of large openings, and neat in appearance.

J. Riprap may be placed in location by equipment; however, take care in placing to obtain a good gradation of materials so that the riprap will be firm and solid. Level surfaces to the required alignment and slopes by hand placing the stone so as to fill large voids and to make the surface even.

K. Place riprap at culvert pipe ends and as shown on Drawings.

3.3 TOLERANCES

A. Maximum Variation from Finished Elevation: Plus or minus 0.1 foot.

END OF SECTION

SECTION 02276

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Construction and maintenance of soil erosion and sediment control barriers in accordance with Ohio erosion and sedimentation control regulations during construction.

1.2 RELATED SECTIONS

- A. Section 01500 - Construction Facilities and Temporary Controls.
- B. Section 02100 - Site Preparation.
- C. Section 02222 - Excavation.
- D. Section 02223 - Backfilling.
- E. Section 02240 - Sludge Stabilization and Removal.

1.3 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Erosion and Sediment Control Plan: Including following:
 - 1. Marked areas of critical erosion.
 - 2. Marked locations of erosion and sediment control measures.
 - 3. Detail construction notes and maintenance schedule for temporary erosion and sediment controls.

1.4 QUALITY ASSURANCE

- A. Perform work of this Section in accordance with state and local erosion and sediment control guidelines.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Material and Equipment: Requirements for transporting, handling, storing, and protecting products.

- B. Protect silt fence materials from hydrocarbon products physical damage, direct sunlight, or other conditions or substances which may degrade the product.

1.6 EXISTING CONDITIONS

- A. Protect off-Site areas from erosion due to on-Site construction activities.
- B. Minimize impact to on-Site areas not involved in construction activities.

1.7 SEQUENCING AND SCHEDULING

- A. Section 01015 - General Requirements: Requirements for coordination.
- B. Temporary erosion control measures shall be in place and functional prior to initiation of earth work activities, Section 02222, 02223, and 02240.

PART 2 PRODUCTS

2.1 STRAW BALE

- A. Wire bound or string tied.
- B. Securely anchored by at least 2 stakes or rebars driven through the bale 12 to 18 inches into the ground.
- C. Chinked (filled by wedging) with straw to prevent water from escaping between the bales.
- D. Entrenched a minimum of 4 inches into the ground.

2.2 SILT FENCE

- A. An assembled, ready to install unit consisting of geotextile attached to driveable posts.
- B. Geotextile: Self supporting polypropylene material. Uniform in texture and appearance with no defects, flaws, or tears that would affect its physical properties. Contain sufficient ultraviolet ray inhibitor and stabilizers to provide a minimum 2-year service life from outdoor exposure.
- C. Posts: Sharpened wood approximately 2 x 4 inches and protrude below the bottom of geotextile to allow a minimum of 1 foot embedment. Post spacing: not to exceed 6 feet. Securely fasten each post to the geotextile and net backing by staples suitable for such purpose.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01015 - General Requirements: Verification of existing conditions before starting work.

- B. Verify that surfaces and Site conditions are ready to receive work.

3.2 PREPARATION

- A. Preserve salient natural features, keep cut-fill operations to a minimum, and ensure conformity with topography so as to create the least erosion and to adequately handle the volume and velocity of surface water runoff.
- B. Whenever feasible, retain, protect, and supplement natural vegetation.
- C. Do not damage, degrade, or in any way cause harm to existing above-ground structure or appurtenance, below-ground utility, pipe, conduit, cable, conductor, or structure.
- D. Performance of temporary erosion control work does not relieve CONTRACTOR of his responsibility for preventing or minimizing the potential for erosion or siltation.

3.3 INSTALLATION

- A. Construct temporary erosion control items in reasonably close conformity with the typical sections and elevation controls shown on Drawings. Actual alignment and/or location of the various items as directed by ENGINEER.
- B. Do not construct silt fence in flowing streams or in swales where there is the possibility of a washout.
- C. Place straw bales in swale and ditches as necessary.
- D. Check weekly and after each rainfall erosion and sediment control measures. During prolonged rainfall, daily checking is necessary.
- E. Straw bales and/or silt fence may be removed at the beginning of the work day, but replace at the end of the work day.
- F. Whenever sedimentation is caused by stripping vegetation, regrading, or other development, remove it from all adjoining surfaces, drainage systems, and watercourses, and repair damage as quickly as possible.
- G. Prior to or during construction, ENGINEER may require the installation or construction of improvements to prevent or correct temporary conditions on Site. Improvements may include berms, mulching, sediment traps, detention and retention basins, grading, planting, retaining walls, culverts, pipes guardrails, temporary roads, and other measures appropriate to the specific condition. All temporary improvements shall remain in place and in operation until otherwise directed by ENGINEER.
- H. Pay close attention to the repair of damaged bales, end runs, and undercutting beneath bales.
- I. Unless otherwise shown on Drawings, or directed by ENGINEER, remove all items upon completion of Works. Spread accumulated sediments to form a suitable surface for seeding or dispose of, and shape the area to permit natural drainage; all to the satisfaction of ENGINEER. All materials once removed become the property of CONTRACTOR.

3.4 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Control: Field inspection and testing.
- B. ENGINEER will inspect all temporary erosion control items for proper placement and maintenance.
- C. Repairs ordered by ENGINEER caused by circumstances not under CONTRACTOR's control after acceptance will be compensated for at Contract rates or as extra work in the absence of comparable items of work. Material used in restoring any original temporary erosion control installation, after the original installations were accepted, will be measured and added to the quantities originally installed.

3.5 CLEANING

- A. Section 01700 - Contract Closeout: Requirements for cleaning installed work.
- B. Clean filters of excessive silt accumulation if and when necessary.
- C. Remove sediment deposits when the level of deposition reaches approximately one-half the height of the barrier.

END OF SECTION

SECTION 02607

MANHOLES AND CULVERTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Modular precast concrete manhole sections with tongue-and-groove joints covers, anchorage, and accessories.
- B. Culverts for access road.

1.2 RELATED SECTIONS

- A. Section 02207 - Supply of Aggregate Materials.
- B. Section 02222 - Excavating: Excavating for manholes and base pads.
- C. Section 02223 - Backfilling: Backfilling after manhole installation.
- D. Section 03300 - Cast-in-Place Concrete.

1.3 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. American Society for Testing and Materials (ASTM):
 - 1. A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 2. C150 - Standard Specification for Portland Cement.
 - 3. C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
 - 4. C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
 - 5. D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).

1.4 DEFINITIONS

- A. SMDD: Standard Maximum Dry Density and in the context of this Contract means the maximum dry unit weight determined in accordance with ASTM D698.

1.5 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.**
- B. Shop Drawings: Indicate manhole locations, elevations, piping, and sizes and elevations of penetrations.**
- C. Product Data: Include for manhole covers, component construction, features, configuration, and dimensions.**
- D. Certificates: Submit manufacturer's certification that precast units meet requirements of this Section minimum 14 days in advance of delivery to Site.**
- E. Manufacturer's Data: Submit manufacturer's drawings and other pertinent data on specified materials minimum 14 days in advance of delivery to Site.**

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum 3 years experience.**
- B. Installer: Company specializing in performing the work of this Section with minimum 3 years documented experience.**

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Material and Equipment: Requirements for transporting, handling, storing, and protecting products.**
- B. Store precast units and handle in a manner to prevent damage to sections or ends.**
- C. Handle precast units by purpose made lift eyes or holes.**

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 01500 - Construction Facilities and Temporary Controls: Requirements for temporary controls.**
- B. Maintain materials and surrounding air temperature to minimum 50 degrees F (10 degrees C) prior to, during, and 48 hours after completion of masonry work.**

1.9 SEQUENCING AND SCHEDULING

- A. Section 01015 - General Requirements: Requirements for coordination.**
- B. Coordinate placement of inlet and outlet pipe or duct sleeves required by other Sections.**

PART 2 PRODUCTS

2.1 MANHOLE

- A. Manhole Sections: Precast reinforced concrete ASTM C478 with gaskets in accordance with ASTM C923.
- B. Concrete Compressive Strength: Minimum 4,000 psi at 28 days.
- C. Cement: ASTM C150 Type IIA.
- D. Reinforcing Steel: ASTM A615 Grade 60.
- E. Joints: Watertight, consisting of the following:
 - 1. Rubber ring gaskets.

2.2 COMPONENTS

- A. Lid and Frame: Halliday access door series RIR60 with locking bar manufactured by Halliday Products Inc. of Orlando, Florida.
- B. Granular Bedding: Type A1 as specified in Section 02207.

2.3 CULVERTS

- A. Corrugated HDPE smooth inside well pipe complying with AASHTO M294 Type S.
- B. Joints: Coupling bends AASHTO standard specification for Highway Bridges. Section 26, paragraph 26.4.2.4(e).
- C. Fitting: AASHTO M294.

2.4 BEDDING

- A. Aggregate Type A1 as specified in Section 02207.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01015 - General Requirements: Verification of existing conditions before starting work.
- B. Verify items provided by other Sections are properly sized and located.
- C. Verify that built-in items are in proper location and ready for roughing into manhole structure.

- D. Verify excavation for manhole is correct.
- E. Obtain approval from ENGINEER prior to installing precast base slab on prepared foundation.

3.2 PREPARATION

- A. Coordinate placement of inlet pipe required by other sections.

3.3 BEDDING

- A. Excavate in accordance with Section 02222. Hand trim excavation for accurate placement of manholes and culverts to elevation indicated.
- B. Place bedding material in layers not exceeding 6 inches compacted depth.

3.4 PLACING MANHOLE SECTIONS

- A. Place prefabricated manhole sections plumb and level, trim to correct elevations.
- B. Construct units in accordance with details shown on Drawings, plumb and true to alignment and grade.
- C. Complete manhole units as pipe laying progresses.
- D. Set the bottom section of precast units on granular bedding as shown on Drawings.
- E. Make each successive joint watertight with specified joint material so that assembled unit is continuous and uniform and interior wall surface is free of appreciable irregularities.
- F. Plug lifting holes with precast concrete plugs set in cement mortar and make watertight.
- G. Outlets: Place stub outlets at elevations and in positions shown on Drawings.
- H. Frames and Covers:
 - 1. Set frames required elevation on top section.
 - 2. Install covers flush in frames where shown on Drawings.
- I. Set cover frames and covers level without tipping, to correct elevations.
- J. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.
- K. Coordinate with other Sections of work to provide correct size, shape, and location.

3.5 BACKFILLING

- A. Backfill manhole in accordance with Section 02223 and as shown on Drawings. Place material carefully against structures so as not to damage structures. Repair damage resulting from backfilling operations around manholes.

3.6 INSTALLATION OF CULVERTS

- A. Install culverts and accessories in accordance with manufacturer's instructions and as directed by ENGINEER.
- B. Backfill around sides and over top of culverts with bedding in layers not exceeding 6 inches compacted depth. Compact each layer to specified density. Provide minimum top cover of 18 inches.

3.7 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Control: Field inspection and testing.

3.8 CLEANING

- A. Clean manholes of debris and foreign material. Remove fins and sharp projections.

3.9 PROTECTION OF FINISHED WORK

- A. Section 01500 - Construction Facilities and Temporary Controls: Requirements for protecting installed work.
- B. Prevent debris from entering system.

END OF SECTION

SECTION 02702

LEACHATE COLLECTION SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe and fittings for leachate collection system.

1.2 RELATED SECTIONS

- A. Section 02207 - Supply of Aggregate Materials.
- B. Section 02223 - Backfilling.
- C. Section 02243 - Geotextile.

1.3 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. American Association of State Highway and Transportation Officials (AASHTO): M252 - Specification for Corrugated Polyethylene Drainage Tubing 3 to 10 inch Diameter.
- C. American Society for Testing and Materials (ASTM): D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).

1.4 DEFINITIONS

- A. SMDD: Standard Maximum Dry Density and in the context of this Contract means the maximum dry unit weight determined in accordance with ASTM D698.

1.5 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Product Data: Include pipe materials, pipe fittings, and accessories.
- C. Manufacturer's Certificates: Certify that products meet or exceed specified requirements.
- D. Record Documents: Indicate actual locations of piping, connections, and invert elevations, identify and describe unexpected variations to subsoil conditions.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum 3 years documented experience.
- B. Installer: Company specializing in performing the work of this Section with minimum 3 years experience.

1.7 PRE-INSTALLATION MEETING

- A. Section 01015 - General Requirements: Requirements for pre-installation meeting.
- B. Convene 1 week prior to commencing work of this Section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Material and Equipment: Requirements for transporting, handling, storing, and protecting products.
- B. Store pipe at Site in locations designated by ENGINEER.
- C. Place pipe on firm supports, clear of the ground, and tilted to ensure no water lies in the pipe.
- D. Handle pipe at all times in a manner to prevent distortion and bending and to protect galvanized surfaces.
- E. Repair or replace damaged pipe as directed by ENGINEER.

1.9 SEQUENCING AND SCHEDULING

- A. Section 01015 - General Requirements: Requirements for coordination.

PART 2 PRODUCTS

2.1 CORRUGATED HDPE PIPE

- A. AASHTO M252 Type SP, slot perforation pattern; 1/16-inch slot width.
- B. Fittings: AASHTO M252.
- C. Joints: Coupling bends, soil-tight to AASHTO Standard Specification for Highway Bridges, Section 26, paragraph 26.4.2.4(e).

2.2 SELECT BACKFILL

- A. Select Backfill: Aggregate material Type A3 as specified in Section 02207.

2.3 GEOTEXTILE

- A. Geotextile: Geotextile Type G-1 as specified in Section 02243.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01015 - General Requirements: Verification of existing conditions before starting work.
- B. Do not commence installation of pipe until the excavation has been inspected and approved by ENGINEER.
- C. Do not commence backfill over installed pipe until the pipe installation has been inspected and approved by ENGINEER.

3.2 PIPE INSTALLATION

- A. Lay pipe so that the flow line of the finished pipe will be at the grade shown on Drawings or as directed by ENGINEER. Commence pipe laying at the inlet end and proceed towards the outlet end with pipes abutting, and true to line and grade.
- B. Carefully clean the ends of pipes before placing; avoid unnecessary handling of pipes while placing pipes on the prepared base. Lay pipes in such a manner that when completed they will form a continuous pipe with a smooth, uniform invert, supported throughout its entire length.
- C. Join sections with approved type couplings on each section end to be jointed.
- D. Place backfill on the prepared base under the haunches and around the pipe in layer not exceeding 6 inches in depth. Compact layer of backfill to a minimum of 95 percent SMDD prior to placement of the succeeding layer.
- E. Simultaneously place and compact backfill evenly on both sides of the pipe.
- F. Do not permit heavy equipment on or across the installation until sufficient cover has been provided to protect the pipe from damage.
- G. Place geotextile on aggregate backfill in accordance with manufacturer's specifications. Stitch or tie seams to prevent movement after placement.

3.3 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Control: Field inspection and testing.
- B. Compaction testing will be performed in accordance with Section 02207 and Section 02223.

3.4 PROTECTION OF FINISHED WORK

- A. Section 01500 - Construction Facilities and Temporary Controls: Requirements for protecting installed work.**

END OF SECTION

SECTION 02750

SAMPLING AND CHEMICAL ANALYSIS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fingerprint testing, PCB screening, characterization and compatibility testing of spent carbon, treatment residuals, sludge and/or soil from wastewater treatment facilities following closure of landfill cap.
- B. Analyses of confirmatory soil samples.
- C. Collection and analyses of influent and effluent samples from wastewater treatment facilities.
- D. Collection and analyses of air samples from stabilization facility air pollution control system.

1.2 RELATED SECTIONS

- A. Section 02757 - Wastewater Treatment.
- B. Section 02240 - Sludge Removal.
- C. Section 02222 - Excavation.

1.3 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. DOT Regulation - 49 CFR Part 172.101 Transport of Hazardous Waste.
- C. USEPA, "A Method for Determining the Compatibility of Hazardous Wastes", EPA 600/2-80-076, April 1980.
- D. Toxic Substance Control Act, 40 CFR 761.
- E. USEPA SW-846 Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods.
- F. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans.

1.4 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Data Sheets: Submit, on daily basis, data sheets for wastes and confirmatory soils sampled previous work day. Submit copies of waste, fingerprint, compatibility, and/or characterization data sheets to ENGINEER within 24 hours of receiving data from laboratory.

- C. Analytical Quality Assurance Project Plan: Prepare in accordance with "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans" (QAMS-005/80) and the Region V Model QAPP (1991) to be submitted within 15 days of the issuance of the Notice to Proceed.
- D. Laboratory Standard Operating Procedures: Submit name of laboratory and copy of laboratory Standard Operating Procedures (SOPs) relevant to scope of work for ENGINEER approval prior to shipping samples for analysis.
- E. Quality Assurance Submittals: During performance of Works, submit submissions listed in Analytical Quality Assurance Project Plan.

1.5 QUALITY ASSURANCE

- A. Perform work of this Section in accordance with Sections 02759 and 02240 and CONTRACTOR's Analytical Quality Assurance Project Plan as approved by ENGINEER and CONTRACTOR's Health and Safety Plan, as specified in Section 01111.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Material and Equipment: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver and ensure sufficient supply of sample jars at Site prior to scheduled sampling activities.
- C. Deliver sampling jars to Site and store in CONTRACTOR's office in area free from contamination. Store sample jars in area protected from environment and free from contaminated materials or substances.

PART 2 PRODUCTS

2.1 SAMPLING EQUIPMENT

- A. Confirmatory Soil Sampling: ENGINEER will provide sampling equipment for collection of confirmatory soil samples.
- B. Stack Testing: CONTRACTOR will provide all equipment, services and personnel to conduct stack tests.
- C. Wastewater Residuals: CONTRACTOR shall provide all equipment, services and personnel to conduct sampling of wastewater treatment plant residuals, sludges, and spent carbon.
- D. Wastewater Influent and Effluent: CONTRACTOR shall provide all equipment, services, and personnel to conduct sampling of wastewater influent and effluent.
- E. Air Pollution Control Residuals: CONTRACTOR shall provide all equipment, services, and personnel to conduct sampling of all air pollution control residuals.

PART 3 EXECUTION

3.1 PREPARATION

- A. Have required health and safety and sampling equipment necessary to perform sampling, prior to commencing opening and sampling activities.

3.2 CONFIRMATORY SOIL SAMPLING

- A. Provide access to and assist ENGINEER in collecting confirmatory soil samples.
- B. Provide sample jars and shipping containers for samples.
- C. Transport samples to laboratory.

3.3 WASTEWATER TREATMENT FACILITY INFLUENT, EFFLUENT, AND RESIDUAL SAMPLING

- A. Collect samples from wastewater treatment facility once every other day during system operation to confirm effluent quality. Collect samples from the post-construction leachate treatment facility once every other day if operated continuously and once every 100,000 gallons if operated in a batch mode. Laboratory shall receive and log in samples at time they arrive at laboratory.

Parameter

Oil and Grease, mg/L
NH₃-N, mg/L
TSS, mg/L
Total Phenols, µg/L
pH, std units
Chromium, µg/L
Copper, µg/L
Lead, µg/L
Benzene, µg/L
Ethyl Benzene, µg/L
Trans 1,2-dichloroethene, µg/L
1,1,1 Trichloroethane, µg/L
Toluene, µg/L
Total Xylenes, µg/L
PCB (total) µg/L

- B. Exact number of samples to be analyzed will vary based on progress of project.
- C. Collect 1 duplicate and 1 matrix spike/matrix spike duplicate when initial sample is collected at Wastewater Treatment Facility.
- D. Analyze samples in accordance with Section 02750 Article 3.10.

- E. Collect representative sample of any wastewater residuals that are not placed in on-Site landfill. These samples shall be characterized using methods meeting the receiving facility requirements and Section 02759.

3.4 AIR EMISSION TESTING

- A. Collect samples from air pollution control equipment stack at three intervals, exclusive of system performance test, during system operation as directed by ENGINEER. Sampling equipment and methodology shall conform to EPA Method 25.
- B. Collect and analyze samples of any residuals from Air Pollution Control activities that can not be stabilized and placed in the landfill in accordance with the off-Site disposal requirements of Section 02759 and disposal facility requirements.

3.5 SAMPLING AND EQUIPMENT CLEANSING

- A. Clean reusable sampling equipment between sampling events using following rinse sequence:
 - 1. Scrub with detergent (Alconox) and clean water rinse to remove visible foreign matter.
 - 2. Rinse with pesticide-grade isopropanol.
 - 3. Air dry for 15 minutes.
 - 4. Rinse with deionized water.
 - 5. Repeat steps 2, 3, and 4.
- B. Following final rinse, visually inspect sampling equipment to verify that they are free of particulates and other solid material which may contribute to possible sample cross-contamination. Do not recycle fluids used for cleaning. Collect wash water, rinse water, and decontamination fluids and transfer to drums pending final disposal at CONTRACTOR's wastewater treatment plant in accordance with Section 01500.

3.6 LABORATORY SERVICES

- A. Provide laboratory test services, requirements of which are generally described by following analytical and laboratory specifications.
- B. Engage testing laboratory that is acceptable to ENGINEER whose work will include, but is not limited to following:
 - 1. Furnishing, preparing, and delivering required sampling and shipping materials to CONTRACTOR on request.
 - 2. Pick up samples as requested by CONTRACTOR.
 - 3. Taking delivery and handling shipping coolers containing samples collected by CONTRACTOR in accordance with sample handling and custody procedures.

4. Analysis of samples in accordance with analytical and laboratory specifications approved by ENGINEER.
 5. Preparation and submission of preliminary and final analytical reports directly and concurrently to CONTRACTOR and ENGINEER.
- C. Submittals: Laboratory shall submit 1 copy of each complete, final analytical report to CONTRACTOR and ENGINEER within time frame specified.
- D. Sampling and Shipping Material:
1. Supply appropriate numbers and types of sampling and shipping material including appropriate sample containers, preservatives, custody seals, labels, shipping coolers and ice packs necessary for shipping samples collected by CONTRACTOR or ENGINEER.
 2. Bottles and containers shall be precleaned or purchased precleaned in accordance with methods specified.
- E. Receipt and Handling of Sample:
1. Laboratory shall receive and log in samples at time they arrive at laboratory.
 2. Samples shall be handled and transported to laboratory under strict chain-of-custody procedures. Each chain-of-custody form accompanying each sample shipment will be signed and dated by CONTRACTOR. Laboratory shall sign chain-of-custody upon receipt.
 3. Immediately upon receipt of each group of field samples, laboratory's sample custodian shall inspect each bottle and/or container for sample integrity, proper labeling and agreement of sample label information with chain-of-custody sheets.
 4. Laboratory shall immediately contact CONTRACTOR and ENGINEER by telephone, and follow up in writing to CONTRACTOR, with copy to ENGINEER, to resolve problems or discrepancies.
- F. Analysis of Samples: Number of samples, specific turnaround time requirements, sample matrix, and target parameters for each sample to be analyzed shall be as specified in specific chain-of-custody document and accompanying paperwork.
- G. Quality Assurance/Quality Control:
1. Quality Control (QC) criteria shall be consistent with methods specified. In addition, the following shall be included:
 1. Each analytical batch shall include:
 1. Date of sample receipt, date of sample extraction and/or analysis.
 2. Laboratory method blank result.
 3. Surrogate recoveries and comparison with laboratory control limits.

4. Laboratory duplicate results.
 5. Laboratory check sample results and comparison with laboratory control limits.
 6. Overall assessment of data (case narrative).
 7. Matrix spike sample results and comparison with laboratory control limits.
2. Furnish an adequate volume of sample material to laboratory for performance of required QC analyses.
 1. Third party "blind" QC check samples shall be analyzed using methods specified at minimum frequency of 1 per month.
 2. Laboratory shall add surrogate compounds to samples and associated QC samples in accordance with methods specified. Surrogate recoveries shall be evaluated with respect to laboratory established control limits and analytical methods.
 3. Quantification of samples analyzed by GC/MS shall be performed by internal standard calibration in accordance with methods specified. Quantification of samples analyzed by GC with relevant selective detectors shall be performed by external standard calibration in accordance with methods specified.

H. Requirements for Analyses:

1. Sample matrices may include surface water, liquid from soil dewatering, soil, oil and wastewater samples.
2. Unless otherwise directed by ENGINEER samples will require 24-hour turnaround time.

I. Reporting and Deliverables:

1. Provide CONTRACTOR and ENGINEER with 1 copy of complete, final analytical report within required turnaround time as specified for each analytical batch of samples. Each analytical report shall include the following:
 1. Sample identification.
 2. Date collected, extracted, analyzed.
 3. Analytical methodology used.
 4. Practical quantitation limit.
 5. Sample dilution (if any).
 6. Original and re-run data.
 7. Copy of sample chain-of-custody.

8. QC data including:
 1. Surrogate used, recovery, and comparison with laboratory control limits.
 2. Method blank results.
 3. Associated check sample results (third party as well as internal).
 4. Parameters analyzed.
 5. Narrative for any analytical problem or irregularities.
 6. Corrective action taken or attempted.
 7. Associated matrix spike sample (if any) results.

J. Data Validity: Validation of analytical data will include, as minimum, the following:

1. Assessment of holding times.
2. Assessment of method blanks.
3. Assessment of surrogates.
4. Assessment of check samples.
5. Completion of data packages.
6. Overall assessment of data.
7. Assessment of matrix spikes (if any).
8. Assessment of field QA/QC samples.

K. Sample Storage: Unless otherwise directed by ENGINEER, CONTRACTOR shall direct laboratory to dispose of unused portions of test samples, extracts and digestates not before 60 days after acceptance of analytical reports by ENGINEER. It shall be CONTRACTOR's responsibility to ensure laboratory disposes of containers, samples, extracts, and digestates in an environmentally safe and acceptable manner and in accordance with applicable local, state, and Federal regulations. CONTRACTOR shall notify ENGINEER prior to disposing of any container, sample, extract, or digestate.

L. Health and Safety: Upon delivery of samples to laboratory, CONTRACTOR and laboratory shall be responsible to ensure that health and safety of laboratory personnel and public are protected during handling, storage, analysis and disposal of samples and that applicable state and federal health and safety protocols are complied with.

3.7 SAMPLE SHIPMENT

A. Pack samples in coolers with appropriate cushioning material in accordance with CONTRACTOR's Analytical Quality Assurance Project Plan. Ship samples to be analyzed off Site

daily to project laboratories by overnight courier or deliver directly by sampling personnel. Ensure sample shipment conforms to 49 CFR § 172.101 DOT regulations for shipping high hazard samples.

- B. Seal each cooler with 2 transportation security seals containing sampler's initials. Seal cooler with packing tape.

3.8 CHAIN-OF-CUSTODY

- A. Maintain control and responsibility of samples. Keep samples under control of CONTRACTOR's sampling personnel in field until relinquished to laboratory. Complete chain-of-custody documents for each cooler and enclose original and 2 copies within cooler. In addition, maintain Field Sampling Data Sheets and sample log of samples collected and shipped off Site. Provide copies of these daily logs, Field Sampling Data Sheets, and copies of completed chain-of-custody documents on daily basis. Chain-of-custody document consists of 4 carbon copies. Retain 1 for CONTRACTOR's sampler, 1 to ENGINEER, 1 to analytical laboratory, and original to be returned by analytical laboratory to CONTRACTOR with analytical results.
- B. Employ typical chain-of-custody form during sample transport. Alternate forms provided by laboratory or CONTRACTOR may be approved for use by ENGINEER provided form is functionally equivalent. Upon receipt of samples at laboratory, designated sample custodian shall inspect cooler and seal for signs of tampering. Conditions of cooler and seal shall be noted on chain-of-custody form by sample custodian and chain-of-custody form shall be signed by sample custodian.
- C. CONTRACTOR shall employ chain-of-custody procedures throughout handling of samples in laboratory from time of receipt to completion of analysis. Completed chain-of-custody forms describing transport to and receipt at laboratory, are required to be returned to CONTRACTOR's Quality Control Manager with hard copy of analytical report. Certification of proper chain-of-custody handling procedures employed in laboratory shall be supplied by laboratory upon request.

3.9 ANALYSES OF CONFIRMATORY SOIL SAMPLES

- A. Analyze individual confirmatory soil samples as directed by ENGINEER.
- B. Chemical analyses performed on specific compounds as follows.

<i>Parameter</i>	<i>USEPA Extraction/Preparation ⁽¹⁾ Method</i>	<i>USEPA Analysis ⁽¹⁾ Method</i>	<i>Routine Reporting Limits (µg/kg)</i>
TCL ⁽²⁾ Volatile Organic Compound	5030	8260 and 8240	10
1,1-Dichloroethene			10
trans-1,2-Dichloroethene			10
Tetrachloroethene			10
Trichloroethene			10
Vinyl Chloride			10

TCL ⁽²⁾ Semi-Volatile Organic Compound	3540/3550	8270	
2-Nitroaniline			1600
Benz(a)anthracene			330
Benzo(a)pyrene			330
Benzo(b)fluoranthene			330
Bis-(2-ethylhexyl)phthalate			330
Chrysene			330
Dibenzo(a,h)anthracene			330
Indeno (1,2,3-cd)pyrene			330
4-Methylphenol			330
Naphthalene			330
Pesticide/PCB	3540/3550	8080	
Total PCBs			160
TAL ⁽³⁾ Inorganics	3050	6010/7000 Series	
Arsenic			0.5 mg/kg
Beryllium			0.5 mg/kg
Lead			10 mg/kg

Notes:

- (1) "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", EPA SW-846, 3rd Edition, September 1986.
- (2) TCL - Target compound List.
- (3) TAL - Target Analyte List.

- C. Analyze and report test results for individual soil samples within 48 hours of sample collection. The data validation assessment and complete laboratory data package shall be provided to the ENGINEER within seven days of sample collection.

3.10 ANALYSES OF WASTEWATER TREATMENT FACILITY EFFLUENT SAMPLES

- A. Target Parameters, Analytical Methods, and reporting limits:

- 1. Required analytical methods and reporting limits are as follows:

<i>Parameter</i>	<i>Analytical Method</i>	<i>Routine Reporting Limit (µg/L)</i>
Oil & Grease, mg/L	EPA-600, Method 413.1	5
NH ₃ -N, mg/L	EPA-600, Method 350.2	1
TSS, mg/L	EPA-600, Method 160.2	10
Total Phenols, µg/L	EPA-600, Method 420.1	10
pH, std units	EPA-600, Method 150.1	—
Chromium, µg/L	EPA-600, Method 200.7	20
Copper, µg/L	EPA-600, Method 200.7	10
Lead, µg/L	EPA-600, Method 239.2	3
Benzene, µg/L	SW-846, Method 8260	1
Ethyl Benzene, µg/L	SW-846, Method 8260	1
Trans 1,2-dichloroethene, µg/L	SW-846, Method 8260	1
1,1,1 Trichloroethane, µg/L	SW-846, Method 8260	1
Toluene, µg/L	SW-846, Method 8260	1
Total Xylenes, µg/L	SW-846, Method 8260	1
PCB (total) µg/L	SW-846, Method 8080	0.5-1.0

2. Compound identification based on single column analysis shall be confirmed on second column.

- B. CONTRACTOR to collect and analyze influent samples at its discretion for proper operation of wastewater treatment facility. No separate payment will be made for collection and analysis of influent.
- C. Laboratory testing results from water samples shall be provided to the ENGINEER within 48 hours of collection.

END OF SECTION

SECTION 02757

WASTEWATER TREATMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Design, construction, operation, and maintenance of Wastewater Treatment Facility in location of CONTRACTOR's choosing with approval by ENGINEER capable of treating wastewaters generated during performance of Works. Sources include:
 - 1. Shower, laundry, and bootwash from Personnel Hygiene/Decontamination Facility.
 - 2. Equipment Decontamination Facility.
 - 3. Lagoon dewatering operations.
 - 4. Excavation dewatering from Works.
 - 5. Precipitation entering any excavation area not approved to accept surface water.
- B. Design, construction, operation, maintenance and removal of Wastewater Treatment Facility capable of treating leachate and potentially contaminated surface water runoff collected at landfill in addition to wastewater sources noted above.
- C. Removal of sanitary wastewaters from toilets for off-Site treatment at an approved sewage treatment facility.
- D. Operation and maintenance of Wastewater Treatment Facilities during Works for a period of up to 2 years after completion of landfill cap.

1.2 RELATED SECTIONS

- A. Section 16050 - Basic Electrical Materials and Methods.
- B. Section 02750 - Sampling and Chemical Analysis.

1.3 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. 100 percent Design Report and Technical Appendices.
- C. United States Environmental Protection Agency (USEPA), "Test Methods For Evaluating Solid Wastes" SW-846, 3rd edition No. 1992.

1.4 DEFINITIONS

A. Wastewater is liquid that is:

1. Wastewater generated from cleaning and decontamination.
2. Waters ponded in active work areas.
3. Water collected from lagoon dewatering.
4. Leachate collected at landfill.
5. Other liquids as may be generated or accumulated in active work area during performance of Works including precipitation, groundwater, and infiltration.

1.5 SYSTEM DESCRIPTION

- A. System will be required to manage wastewater for entire Contract period. Design, obtain ENGINEER approval and implement management program compatible with construction schedule and methodologies selected to undertake Contract.
- B. Treat wastewater to discharge criteria listed in Article 3.8.
- C. System shall be designed to treat wastewater which will vary in quality/quantity. Historic characteristics of wastewater removed from lagoons is shown in Article 3.8.
- D. System shall be designed to include, at a minimum, oil/water separation, sand filtration, metals removal, pH adjustment, carbon adsorption, and ammonia removal. The design of flow shall be at least 125 gpm.
- E. Furnish emergency storage capacity as contingency measure to be utilized only following approval by ENGINEER.
- F. Furnish storage for waters collected in active sludge removal areas during and following rainfall events. Capacity of storage tanks to be sufficient to prevent delay of work. No extra payment will be made for delays due to CONTRACTOR's inability to discharge treated water during and after rainfall events. Backup of water into work areas due to insufficient storage or pumping capacity will be responsibility of CONTRACTOR at no additional cost to TRUST.
- G. Maintain complete segregation of clean and unremediated areas. Recontamination of cleaned areas will require full retesting and verification of base conditions in event of spill or other similar event. Cost for retesting and verification of base conditions due to CONTRACTOR's failure to maintain segregation between clean and unremediated areas will be CONTRACTOR's responsibility.

1.6 DESIGN REQUIREMENTS

- A. Design temporary Wastewater Treatment Facility for duration of Work.

- B. Separate wastewater storage tanks (insulated/heated) for:
 - 1. Personnel Hygiene/Decontamination Facility (not including toilets).
 - 2. Equipment Decontamination Facility.
 - 3. Temporary Wastewater Treatment Facility.
- C. Process equipment, tanks, pumps, piping, pressure and flow instrumentation, and miscellaneous appurtenances as necessary to operate systems.
- D. Site-dedicated mobile tanker (minimum 3,500 gallon) as required to transport wastewater.
- E. Totalizing flow meters accurate to 0.5 percent.
- F. Wastewater Treatment Facility to be capable of receiving liquid/solid mixtures and not cause delays to decontamination activities.
- G. Protect wastewater treatment system and piping from freezing.
- H. Furnish emergency storage capacity for rainfall events generating additional wastewater in active work areas.
- I. Minimum wastewater storage volume for each wastewater facility is as follows:

<i>Location</i>	<i>Minimum Total Storage Volume (gallons)</i>	<i>Minimum Number of Tanks per Storage Facility</i>
Personal Hygiene/Decontamination Facility	10,000	2
Equipment Decontamination Facility	10,000	2
- J. Design wastewater storage facilities, including secondary containment in event of storage failure.

1.7 PERFORMANCE REQUIREMENTS

- A. Discharge Criteria as presented in Article 3.8.
- B. Following installation of treatment facilities, test facilities to demonstrate systems are capable of achieving treatment criteria prior to discharging treated effluent as described in Article 3.5.
- C. Ensure discharges from Site are in compliance with applicable permit requirements and limitations with no surcharges.
- D. Maintain working area free of standing water.

1.8 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Detailed Wastewater Treatment Plan: Within 15 days after the date of Notice to Proceed, submit Detailed Wastewater Treatment Plan based on Preliminary Wastewater Treatment Plan submitted with bid incorporating and addressing review comments provided by ENGINEER and TRUST. Include process and instrumentation diagrams, equipment selected, storage and pumping capacities, effluent monitoring program, operating plan compatible with and demonstrating compliance with specified requirements for temporary Wastewater Treatment Facilities. Design must be approved by ENGINEER prior to construction of Wastewater Treatment Facilities.
- C. Quality Assurance Project Plan : Within 15 days after issuance of Notice to Proceed, submit detailed Quality Assurance Project Plan as detailed in Section 02750.
- D. Product Data: Include product data sheets or brochures of key elements of Wastewater Treatment Facility for standardized components, and Drawings and calculations sealed by professional engineer registered in State of Ohio for non-standardized components.
- E. Design Data: Indicate tank sizes, pump sizes, and treatment rates.
- F. Solids/Sludge Waste Data: Indicate how solids/sludge wastes to be managed after completion of landfill cap and submit disposal plan for approval.

1.9 QUALIFICATIONS

- A. Design Wastewater Treatment Facility under direct supervision of professional engineer experienced in design of work of this Section and licensed in State of Ohio.

1.10 REGULATORY REQUIREMENTS

- A. Discharge of treated effluent to sanitary sewer from Wastewater Treatment Facilities is subject to requirements of USEPA and OEPA.
- B. Piping and handling facilities for all lagoon dewatering and leachate removal activities shall include secondary containment and employ spill prevention measures.

1.11 PRE-INSTALLATION MEETING

- A. Section 01015 - General Requirements: Requirements for pre-installation meeting.
- B. Convene 1 week prior to commencing installation of Wastewater Treatment Facility.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Material and Equipment: Requirements for transporting, handling, storing, and protecting products.

- B. Protect equipment from precipitation by suitable covers or structures.
- C. Protect supplies (e.g., sand, activated carbon) from precipitation by suitable covers or structures.
- D. Maintain adequate supplies to maintain operations.
- E. Maintain and service equipment to ensure they are in working order.

1.13 ENVIRONMENTAL REQUIREMENTS

- A. Section 01500 - Construction Facilities and Temporary Controls: Requirements for temporary controls.
- B. Maintain emergency storage capacity during Works for storm events.

1.14 SEQUENCING AND SCHEDULING

- A. Section 01015 - General Requirements: Requirements for coordination.
- B. Sequence work to have Wastewater Treatment Facility installed, tested, and inspected by ENGINEER prior to commencing work which may generate wastewater.

PART 2 PRODUCTS

2.1 EQUIPMENT

- A. Provide wastewater treatment systems capable of meeting discharge criteria.

2.2 SOURCE QUALITY CONTROL

- A. Section 01400 - Quality Control: Requirements for source testing and analysis of treatment system effluent.
- B. Compliance testing in accordance with Section 02750. Retesting, surcharges, or other costs associated with non compliance are responsibility of CONTRACTOR.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01015 - General Requirements: Verification of existing conditions before starting work.

3.2 INSTALLATION

- A. Install Wastewater Treatment Facility at location approved by ENGINEER.

3.3 STORAGE FACILITIES

- A. Place tanks above ground, heat, and insulate. Tanks shall be leakproof and pressure tested. Repair any leaks found. Visually check tanks for leaks and promptly repair on daily basis as necessary. Repair or replace at no additional cost to TRUST any tanks that leak. Supply pipes, flanges, connections, and any other appurtenances required to place wastewater in or remove wastewater from storage tanks. Tanks shall include float levels for monitoring levels and access manholes/portholes for decontamination of tanks and for sampling. Tanks shall provide secondary containment equal to or greater than the volume of the largest tank in accordance with Federal and State regulations.

3.4 TREATMENT

- A. Treat collected wastewater and release treated wastewater meeting approved discharge criteria and requirements to designated receiver.
- B. Empty wastewater tanks and emergency storage and treat wastewater at frequency required to eliminate risk of exceeding capacity of storage tanks and emergency storage.

3.5 STARTUP PROCEDURES

- A. Process sufficient volume of raw wastewater until system operation has stabilized. Recycle effluent to one of the lagoons. Use of tankage at CONTRACTOR's sole expense is optional upon approval by ENGINEER.
- B. Collect representative sample and analyze for parameters listed in Article 3.8 of this Section in accordance with Section 02750. If sample meets discharge criteria, collect a second sample after at least 24 hours of treatment system operation. Continue operation and recycling until two successive samples meet discharge criteria.
- C. Submit analytical data to ENGINEER. ENGINEER will submit data to USEPA for review and approval.
- D. Do not commence discharge prior to receipt of authorization from ENGINEER.

3.6 OPERATION

- A. Do not operate Wastewater Treatment Facility until ENGINEER has inspected facility and authorization for discharge has been received.
- B. Operate Wastewater Treatment Facility and do work necessary to treat collected wastewater as required. Operation shall include treatment of feed tank wastewaters and discharge of treated water for duration of Works.
- C. Operate and maintain treatment units as required to meet discharge criteria and flow rate requirements. Provide for removal of oils, non-aqueous liquids and solids as necessary. Stabilize sludges in accordance with Section 02240 prior to disposal at on-Site landfill.

- D. If resin or carbon media is utilized, provide for removal and disposal of media in approved CONTRACTOR supplied containers to an approved facility or in the on-Site landfill.
- E. Systems to be operated on a continuous discharge basis. Discharge is permitted when initial analytical results confirming compliance with discharge criteria are received and reviewed by ENGINEER. Until approved to receive, treated wastewater shall be pumped or recycled into one of the lagoons.
- F. Provide daily flow rate data for each treatment facility to ENGINEER on a weekly basis.

3.7 SAMPLING AND ANALYSIS

- A. Collect and analyze samples from wastewater treatment facilities in accordance with Section 02750.

3.8 DISCHARGE LIMITS

- A. Maximum discharge limits:

<i>Parameter</i>	<i>Influent Range¹</i>	<i>Allowable Discharge Criteria</i>
Oil and Grease, mg/L	6-60	10
NH ₃ -N, mg/L	ND-140	1.5
TSS, mg/L	1-550	30
Total Phenols, µg/L	12-32,000	10
pH, std units	6.9-8.4	6.5-9
Chromium, µg/L	ND-585	54
Copper, µg/L	ND-30	23
Lead, µg/L	ND-87	30
Benzene, µg/L	ND-115	5
Ethyl Benzene, µg/L	ND-48	142
Trans 1,2-dichloroethene, µg/L	ND-5.5	5
1,1,1 Trichloroethane, µg/L	ND-258	88
Toluene, µg/L	ND-824	2,000
Total Xylenes, µg/L	ND-263	440
Total PCBs, µg/L	ND-10	ND ²

Notes:

¹ Influent characteristics in this table are based on limited analytical data. Parameter concentrations will vary significantly depending on agitation of lagoon contents. CONTRACTOR should account for variation in design and operation of treatment system. Chlorinated and non-chlorinated volatile organics not included above are likely present in the influent water.

² ND -Non-detect, with detection limit of 0.1 µg/L for Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260.

3.9 FAILURE TO MEET CRITERIA

- A. Should analyses indicate that effluent has not met treatment criteria, immediately cease discharge and store or recycle any additional water on Site. Collect and analyze second sample of recently treated water. If second sample also fails to meet criteria, perform full check on Wastewater Treatment Facility system, including replacement of granular activated carbon (GAC) and/or filter media, if necessary. Do not release treated water until startup testing as described in Article 3.5 has verified that system is capable of treating water to specified criteria to satisfaction of ENGINEER. Retesting and retreating wastewater to meet criteria is at CONTRACTOR's expense. Stored off-specification effluent to be treated prior to release off Site.
- B. Provide sufficient storage on Site until treatment criteria can be met. Store wastewater, carry out system checks, and repair system.

3.10 DECOMMISSIONING

- A. Decontaminate temporary Wastewater Treatment Facilities prior to removal from Site.

3.11 TOILET WASTEWATER

- A. Store wastewater from toilet facilities separately in storage tanks on Site.
- B. Remove toilet wastewater from Site without pretreatment to a POTW.

END OF SECTION

SECTION 02759

TRANSPORTATION AND OFF-SITE DISPOSAL/TREATMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Supply, operation, and maintenance of transport vehicles/containers.
- B. Preparing transport vehicles/containers for off-Site transportation.
- C. Loading and securing materials in transport vehicles/containers.
- D. Weighing transport vehicles/containers.
- E. Decontaminating vehicles/containers prior to leaving Site.
- F. Transporting materials from Site to approved off-Site disposal/treatment facilities after completion of the landfill cap.
- G. Preparation of shipping and manifesting documents including waste profiles, manifests and bills of lading.
- H. Maintaining transportation records as required by regulatory agencies.
- I. Acceptance testing.

1.2 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. United States Federal Government - Code of Federal Regulations (CFR):
 - 1. 40 CFR 261 - Identification and Listing of Hazardous Waste.
 - 2. 40 CFR 262 - Standards Applicable to Generators of Hazardous Waste.
 - 3. 40 CFR 263 - Standards Applicable to Transporters of Hazardous Waste.
 - 4. 40 CFR 264 - Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal.
 - 5. 40 CFR 265 - Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal.
 - 6. 40 CFR 279 - Standards for the Management of Used Oil.
 - 7. 40 CFR 761 - Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions.

8. 49 CFR 171 - General Information, Regulations, and Definitions.
9. 49 CFR 172 - Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements.
10. 49 CFR 173 - Shippers - General Requirements for Shipments and Packaging.
11. 49 CFR 174 - Carriage by Rail.
12. 49 CFR 176 - Carriage by Vessel.
13. 49 CFR 177 - Carriage by Highway.

1.3 DEFINITIONS

- A. RCRA Characteristic Wastes: Materials as defined in 40 CFR 261 Subpart C.
- B. PCB Wastes: Materials as defined in 40 CFR 761.
- C. Used or Waste Oil: Materials as defined in 40 CFR 279.
- D. Non-hazardous Materials: Materials not regulated by 40 CFR 261, and 40 CFR 761.

1.4 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Transportation and Disposal/Treatment Proposal: Submit for review and approval a proposal for transportation and disposal/treatment of materials 14 days prior to transportation and disposal/treatment of materials from Site. Include relevant transporter and disposal/treatment facility identifications and status, methods of transportation and disposal/treatment, contingency plans for spills during transportation, and schedule for transportation and disposal/treatment. Identify facility-specific requirements for waste profiling sampling and analyses to determine acceptance for disposal/treatment.
- C. Letters of Commitment:
 1. Include a copy of the letter of commitment from each proposed disposal/treatment facility prior to shipping material to the facility. State in each letter:
 1. That facility is in compliance with its current and valid permits.
 2. That facility can and will accept the materials, contingent upon acceptance of waste profile, proposed for disposal/treatment at the facility.
 3. Facility restrictions which may cause rejection of transported materials.
 4. Additional sampling and analysis of materials which are required prior to delivery to facility.

5. Restrictions on delivery schedules.
2. Each facility shall disclose information concerning existing corrective action programs which may impact the ability of the facility to accept materials from Site.
- D. Agency Approvals: Letters of approval from USEPA and applicable state agencies which approve the disposal/treatment of materials from Site at each proposed facility 7 days prior to off-Site transportation of materials.
- E. Operating Licenses and Permits:
 1. Include copies of valid operating licenses and permits for each proposed facility 7 days prior to commencing transportation of materials from Site.
 2. Include copies of valid operating licenses and permits from each transporter for each proposed transport vehicle/container 7 days prior to entry to Site.
- F. Transportation Routes: Submit detailed plans showing transportation routes or alternate routes which will be used to transport materials to each disposal/treatment facility 7 days prior to commencing transportation of materials from Site. Comply with applicable federal, state, and local regulations.
- G. Shipping and Disposal/Treatment Documents:
 1. Include blank sample forms of proposed shipping and disposal/treatment documents at least 14 days prior to use.
 2. Include complete copies of waste profiles.
 3. Include completed copies of shipping and disposal/treatment documents including manifests and/or bills of lading on standard approved forms, including a copy of each form signed by the transporter prior to leaving Site and a copy of each form signed by the disposal/treatment facility accepting the shipment. Use shipping and disposal/treatment documents of consignment state where so required.
 4. Include completed certificates of disposal/destruction/treatment/recycle as applicable and issued by the facility following acceptance and final disposition of the shipment.
- H. Supplemental Indemnifications: For each facility which provides a supplemental indemnification (e.g., Superfund Indemnification), obtain such indemnification for the benefit of TRUST. Submit to ENGINEER.
- I. Weigh Scales:
 1. Include state calibration certificates for off-Site weigh scales.
 2. Include copies of weigh scale tickets on approved forms signed by an authorized weigh scale operator including the following information:
 1. Location, date, and time of weighing.

2. Measured weights.
3. Vehicle and container identification.
4. Shipment identification number.

J. **Analytical Test Results:** Include analytical results of acceptance testing for material removed from Site whether performed by or on behalf of CONTRACTOR.

1.5 QUALITY ASSURANCE

- A. **Perform waste profiling analyses of materials, scheduled for off-Site disposal/treatment as required by and to the satisfaction of the operators of the off-Site disposal/treatment facilities and federal, state, and local regulations, prior to transport from Site.**
- B. **Sample and analyze materials scheduled for transportation and off-Site disposal/treatment to verify that the type and concentration level of contaminants present lie within acceptable ranges established by the approved wastestream description for each of the off-Site disposal/treatment facilities. Determine the sampling and analysis requirements with the disposal/treatment facility. Sampling and analysis protocols shall be CONTRACTOR's responsibility. Performance or non-performance of sampling and analysis of materials will not relieve CONTRACTOR of the responsibility of ensuring that transported materials will be accepted by the disposal/treatment facility. CONTRACTOR is responsible for determining the regulatory classification of materials scheduled for disposal.**

1.6 ENVIRONMENTAL REQUIREMENTS

- A. **Section 01500 - Construction Facilities and Temporary Controls: Requirements for temporary controls.**
- B. **Do not spill, leak, or otherwise release materials from transport vehicles and containers during loading and unloading operations or while in transit from Site to the disposal/treatment facility.**
- C. **Clean up any and all spills or leaks in transit.**

PART 2 PRODUCTS

2.1 CONTAINERS, PACKING MATERIAL, AND LABELS

- A. **Comply with DOT, federal, state, and local regulations.**

PART 3 EXECUTION

3.1 EXAMINATION

- A. **Section 01015 - General Requirements: Verification of existing conditions before starting work.**

- B. Notify ENGINEER sufficiently in advance of intention to commence activities at Site that require attendance by ENGINEER as provided hereinafter.
- C. Activities requiring attendance by ENGINEER include:
 - 1. Final securement of loaded materials prior to transport from Site.
 - 2. Decontamination of transport vehicles/containers prior to leaving Site.
- D. Do not cover up loaded material prior to ENGINEER's inspection.

3.2 WASTE PROFILING

- A. Conduct waste profile sampling and analysis in accordance with requirements of regulating agencies.
- B. ENGINEER may perform confirmatory sampling and/or analysis. Such sampling and/or analysis or failure to perform such sampling and/or analysis by ENGINEER shall not release or reduce CONTRACTOR's obligation to perform Works in accordance with the requirements of Contract Documents. Do not remove materials from Site which have been sampled by ENGINEER and are awaiting analytical results. ENGINEER will receive analytical results within 7 days of ENGINEER's sample collection. ENGINEER will provide copies of ENGINEER's analytical results to CONTRACTOR upon request.
- C. Submit to ENGINEER completed waste profile for each wastestream. Waste profile will be signed by TRUST or an authorized agent of TRUST except for materials brought on Site by CONTRACTOR.
- D. Submit signed waste profiles to disposal/treatment facilities.

3.3 SEGREGATION OF MATERIALS

- A. Do not segregate materials for disposal/treatment until waste profiles are approved by each disposal/treatment facility.
- B. Segregate and prepare materials for transportation and disposal/treatment in accordance with the delivery acceptance requirements of the transporter and disposal/treatment facility and governing regulations.

3.4 PREPARATION AND SECUREMENT OF TRANSPORT VEHICLES/CONTAINERS

- A. Comply with applicable federal, state, and local regulations concerning shipping materials.
- B. Visibly display number for each transport vehicle/container.
- C. Clean the receiving box of the transport vehicle/container of loose debris or foreign material. Line the receiving box or container with minimum 1 layer of 6-mil polyethylene sheeting continuous along the bottom and sides. Place the sheeting on the floor, run up the sides, and

drape over the sideboards. Neatly push the polyethylene sheeting into corners to prevent tearing during loading and transport.

- D. Secure materials in transport vehicles/containers in accordance with regulations governing transportation of these materials.
- E. Load materials into transport vehicles or containers in a manner which will not damage the properly placed polyethylene sheeting. Limit the freefall of bulk materials being loaded. Place cushioning materials under and around each container for shipments of drummed/containerized materials.
- F. Replace damaged sheeting which is incapable of providing containment.
- G. Following loading, fold the tub liner over the loaded materials and place an overliner of polyethylene sheeting over the materials prior to securing with an approved tarpaulin in a manner to prevent loss of materials or fugitive dust emissions.
- H. ENGINEER will waive the box or container lining requirements where CONTRACTOR can demonstrate, to the satisfaction of ENGINEER, that all of the following conditions are met:
 - 1. The receiving box or container is of leakproof construction and capable of maintaining a leakproof condition.
 - 2. The cover to be placed over the receiving box or container is impermeable and will totally enclose the materials within.
 - 3. The cover to be placed over the receiving box or container will prevent fugitive dust emissions.
 - 4. The receiving box or container is constructed of materials which can be decontaminated.
- I. Inspect bulk liquid tankers prior to use.

3.5 DECONTAMINATION

- A. Decontaminate transport vehicles and containers at on-Site equipment decontamination pad after loading and prior to leaving Site. Remove material on the tires and axles of trucks and material on the vehicle resulting from loading operations.

3.6 DOCUMENTATION FOR THE TRANSPORTATION OF MATERIALS

- A. Document the transport and disposal/treatment of RCRA characteristic wastes and/or PCB wastes to off-Site facilities on appropriate state and/or federal manifests as required. Prepare, maintain, and provide ENGINEER with copies of manifests and/or other records for each shipment of materials from Site. Maintain manifests from the time the materials leave Site to the time of release to the disposal/treatment facilities. Manifests for the transportation and disposal/treatment of materials will be signed by TRUST or an authorized agent of TRUST, except for materials brought on Site by CONTRACTOR.

- B. Document the transport and disposal/treatment of used oil and non-hazardous materials to off-Site facilities on appropriate state and/or federal manifests or bills of lading. Prepare, maintain, and provide ENGINEER with copies of manifests and/or bills of lading for each shipment of materials from Site. Maintain manifests or bills of lading from the time the materials leave Site to the time of release to the facilities. Sign manifests or bills of lading for the transportation and disposal/treatment of non-hazardous material. Manifests or bills of lading for the transportation and disposal/treatment of non-hazardous material will be signed by TRUST or an authorized agent of the TRUST, except for materials brought on Site by CONTRACTOR.

3.7 NOTIFICATION

- A. Notify applicable federal, state, and local representatives, or authorities having jurisdiction over the route and mode of transport, in advance of commencing transportation.

3.8 PRE-TRANSPORT WEIGHING

- A. Weigh transport vehicles with and without loaded materials at a certified off-Site disposal facility weigh scale facility approved by ENGINEER. Perform weighing operations in such a manner that the net weight of loaded materials can be determined to the satisfaction of ENGINEER.
- B. Verbally report to ENGINEER the net weight for completion of manifests/bills of lading and obtain verbal approval from ENGINEER prior to commencing transport to the disposal/treatment facility. Transport vehicle operators may be instructed by ENGINEER to return to Site following weighing if loads are determined to be excessively light or heavy.
- C. Submit written weigh scale receipts to ENGINEER within 24 hours of weighing; ensure weigh scale receipts agree with the verbally reported quantity and manifest/bill of lading quantities.

3.9 TRANSPORTATION

- A. Transport material removed from Site directly to the disposal/treatment facility approved by ENGINEER. Do not change either the route or mode of transport after commencing off-Site operations without ENGINEER's prior written approval.
- B. Comply with applicable requirements of regulatory publications including, but not limited to 49 CFR 171, 49 CFR 172, 49 CFR 173, 49 CFR 174, 49 CFR 176, and 49 CFR 177.
- C. Mark and placard shipments in accordance with DOT, 40 CFR 262, 40 CFR 279, and 40 CFR 761, as applicable.
- D. Employ transport vehicle operators trained in conformance with federal, state, and local regulations for hazardous materials haulers.
- E. Regardless of regulatory waste classification, materials shall be transported using vehicles licensed to transport hazardous wastes.

3.10 DISPOSAL/TREATMENT

- A. Make arrangements with disposal/treatment facilities for the receipt and acceptance of materials removed from Site.
- B. Ensure that materials removed from Site are properly prepared and will be accepted by the disposal/treatment facility. Dispose/treat materials in facilities approved by ENGINEER which are in compliance with applicable regulations and permitted to receive materials from Site.
- C. Weigh transport vehicles/containers at approved off-Site disposal facility weigh scales both before and after discharging their contents.
- D. Such measurements will be used by ENGINEER to verify proper delivery of materials which have been removed from Site and for payment purposes. Transportation to an off-Site facility will be suspended in the event of discrepancy between the net weight as recorded by the state certified weigh scale and the disposal facility scale.
- E. Return to Site any transported material delivered to a facility which is rejected by the facility.

3.11 DISPOSITION OF MATERIALS

- A. Select and submit proposals to ENGINEER for the appropriate disposition of all determined wastestreams to be removed from Site in accordance with applicable regulations for each wastestream. CONTRACTOR shall be responsible for disposition of materials to approved off-Site facilities including RCRA and/or TSCA incinerators, RCRA Subtitle D landfills, RCRA Subtitle C landfills, used oil management facilities, and industrial waste treatment facilities.
- B. Do not load materials for transport for disposal without ENGINEER's approval. Do not cover or otherwise obstruct access to materials to be sampled and analyzed by ENGINEER to confirm their appropriate disposition. ENGINEER will provide the analytical results of such sampling and analysis to CONTRACTOR upon request.

3.12 OFF-SITE RCRA AND/OR TSCA INCINERATOR

- A. Dispose of materials at RCRA and/or TSCA licensed incinerator approved by ENGINEER.
- B. The facility shall be USEPA permitted to receive RCRA and/or TSCA wastes as applicable and shall be in compliance with applicable regulatory requirements including but not limited to 40 CFR 264, 40 CFR 265, and 40 CFR 761.
- C. The facility shall be inspected and passed by the appropriate federal and state officials responsible for RCRA and/or TSCA program within 6 months prior to receipt of material from Site. ENGINEER will have the right to inspect/audit the facility at all reasonable times.
- D. The facility shall not have any significant regulatory violations or other environmental conditions that could affect its satisfactory operation or its ability to accept contaminated materials from Site during the performance of this Contract. Such regulatory violations shall include violations under TSCA, RCRA, or other federal, state, and local regulations.

3.13 OFF-SITE WASTEWATER TREATMENT FACILITY

- A. Dispose of wastewaters not treatable to the discharge criteria specified in Section 02757 at an industrial wastewater treatment facility approved by ENGINEER.
- B. The treatment facility shall have RCRA and/or TSCA permit or RCRA and/or TSCA interim status to treat any RCRA and/or TSCA wastes encountered on Site.
- C. The facility shall be inspected and passed by the appropriate federal, state, and local representatives responsible for RCRA and/or TSCA program within 6 months prior to receipt of wastewater under this Contract.
- D. The facility shall not have any significant regulatory violations or other environmental conditions that could affect its satisfactory operation or its ability to accept wastes from Site during the performance of this Contract. Such regulatory violations include violations under RCRA and/or TSCA or other federal, state, and local regulations.

3.14 DRUM RECYCLING FACILITY, WASTE OIL RECYCLING FACILITY, AND TSD FACILITY

- A. After capping of the landfill, dispose of drums, non-hazardous waste oil, and excavated drummed inorganic waste, as applicable, at facilities approved by ENGINEER and in compliance with applicable regulations, including RCRA, TSCA, USEPA, or other federal, state, and local regulations.

3.15 RCRA BOILER AND INDUSTRIAL FURNACES

- A. Dispose of drums and hazardous waste oil as applicable, at a RCRA boiler and industrial furnace facility approved by ENGINEER and in compliance with all applicable regulations (i.e., 40 CFR 266), including RCRA, USEPA, federal, state, and local regulations.

3.16 RCRA SUBTITLE C LANDFILL

- A. Dispose of filter media from CONTRACTOR's wastewater treatment system following closure of the on-Site landfill cap, at RCRA Subtitle C landfill approved by ENGINEER.
- B. The facility shall be inspected by the appropriate federal, state, and local representatives responsible for TSCA or RCRA program within 6 months prior to receipt of material under this Contract.
- C. The facility shall not have any significant regulatory violations or other environmental conditions that could affect its satisfactory operation or its ability to accept materials from Site during performance of this Contract. Such regulatory violations shall include violations under TSCA, RCRA, or other federal, state, and local regulations.
- D. Determine the location of materials placed within the landfill and document with respect to permanent horizontal and vertical control points.

3.17 RCRA SUBTITLE D LANDFILL

- A. Dispose of non-hazardous materials at RCRA Subtitle D landfill approved by ENGINEER.
- B. The facility shall be permitted to receive solid wastes, other than hazardous wastes, by USEPA, the State of Ohio, and/or all other authorities having jurisdiction.
- C. Prepare a report for each shipment of waste materials to the sanitary landfill. Submit report to ENGINEER no later than the next working day following each day's shipment. The report shall contain as a minimum:
 - 1. The total weight of wastes shipped.
 - 2. A description of wastes shipped.
 - 3. A receipt signed by the landfill operator showing the weight of waste material received in each shipment, the date and time of day each load is discharged, and a brief description of the waste materials.

END OF SECTION

SECTION 02936

SEEDING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preparation of subgrade.
- B. Hydroseeding.
- C. Maintenance.
- D. Erosion control blanket.

1.2 RELATED SECTIONS

- A. Section 02205 - Supply of Soil Materials: Topsoil material.
- B. Section 02223 - Backfilling: Rough grading of Site.

1.3 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. FS: FS O-F-241 - Fertilizers, Mixed, Commercial.

1.4 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.
- B. Noxious Weeds: Harmful, undesirable, hard to control:
 - 1. Restricted: May be sold in the trade but are limited to very small amounts as undesirable contaminants.
 - 2. Prohibited: Prohibited from sale.
- C. Prohibited Noxious Weeds: Include Johnson Grass or Johnson Grass Crosses, Canadian Thistle, and Quackgrass.
- D. Restricted Noxious Weeds: Include Wild Garlic and Wild Onion, Bermuda Grass, Annual Blue Grass, Corn Cockle, Dodder, and Blindweed.

1.5 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Certificates: Submit certificates from seed vendors for each seed mixture required, stating botanical and common name, percentage by weight and percentages of purity, germination, and weed seed for each species.
- C. Maintenance Data: Include maintenance instructions, cutting method, and maximum grass height; application frequency, and recommended coverage of fertilizer.

1.6 QUALITY ASSURANCE

- A. Perform work of this Section in accordance with Natural Resources Conservation Service.
- B. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.7 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Material and Equipment: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver grass seed mixture in original sealed containers. Seed in damaged packaging is not acceptable. Label containers showing:
 - 1. Analysis of seed mixture.
 - 2. Percentage of pure seed.
 - 3. Year of production.
 - 4. Net weight.
 - 5. Date when tagged and location.
 - 6. Percentage germination.
 - 7. Name and address of distributor.
- C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

- D. Deliver mulch and erosion control agent in moisture-proof containers showing manufacturer, content, and net weight (air dry).
- E. Deliver erosion control blankets in a rolled mat form protected with an outer waterproof wrap bearing the manufacturer's label indicating product name.
- F. Store materials in accordance with manufacturer's instructions and in a manner to prevent damage or deterioration. Remove from Site seed which has become wet, moldy, or otherwise damaged in transit or storage.
- G. Store seed in weatherproof enclosures.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Section 01500 - Construction Facilities and Temporary Controls: Requirements for temporary controls.
- B. Do not apply materials over snow, ice, or standing water.
- C. Do not apply seed slurry when wind conditions are such that material would be carried beyond designated area or that materials would not be uniformly applied and when wind velocity exceeds 5 miles per hour.

1.10 SEQUENCING AND SCHEDULING

- A. Section 01015 - General Requirements: Requirements for coordination.
- B. Schedule topsoil placing to permit seeding operations under optimum conditions during normal planting seasons.
- C. Coordinate planting with specified maintenance periods to provide maintenance until occupancy by TRUST.
- D. Ensure permanent vegetative cover accomplished within 10 days of completion of topsoiling.

1.11 MAINTENANCE SERVICE

- A. Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition as accepted by ENGINEER.

PART 2 PRODUCTS

2.1 SEED MIXTURE

- A. Mixture of the following:
 - 1. Kentucky Blue Grass: 5 to 10 percent.

2. Creeping Red Fescue Grass: 20 to 30 percent.

3. Norlea Perennial Rye: 20 to 30 percent.

4. Toll Fescue Grass: Remainder to obtain 100 percent.

B. Grass Seed: Fresh, clean, new-crop seed complying with the tolerance for purity and germination established by Official Seed Analysis of North America; minimum germination of 75 percent and minimum purity of 97 percent; obtained from an approved seed house.

C. Weed Seed Content: Not over 0.25 percent and free of noxious weeds.

2.2 TOPSOIL

A. Section 02205, Type S2.

2.3 MULCH

A. Straw Mulch: Oat or wheat, free from weeds, foreign matter detrimental to plant life, and dry; seasoned for spreading with mulch blower equipment. Hay or chopped cornstalks are not acceptable.

2.4 FERTILIZER

A. Granular form, dry, free flowing, and free from lumps.

B. FS O-F-241 recommended for grass, with 50 percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil as indicated in analysis to the following proportions: nitrogen 6 percent, phosphoric acid 12 percent, soluble potash 12 percent.

2.5 WATER

A. Clean, fresh, potable, and free of any contaminants and substances or matter which could inhibit germination and vigorous growth of grass.

2.6 EROSION CONTROL BLANKET

A. Coconut Blankets: C125 as manufactured by North American Green.

B. Excelsior Blankets: ECS Standard 1010-04 as manufactured by Erosion Control Systems, Inc. or equivalent.

2.7 ACCESSORIES

A. Erosion Control Agent:

1. Non-flammable, non-asphaltic, naturally occurring powder blended from hydrophilic colloidal clay compound mixed with gelling agents and growth stimulants.
2. RMB Plus Tackifier as manufactured by Reinco Mulch Binder Co.

2.8 SOURCE QUALITY CONTROL

- A. Section 01400 - Quality Control: Requirements for source testing and analysis of mix formulation for hydroseeding.
- B. Analyze fertilizer to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01015 - General Requirements: Verification of existing conditions before starting work.
- B. Verify that prepared soil base is ready to receive work of this Section.

3.2 PREPARATION - SUBGRADE

- A. Prepare subgrade to eliminate uneven areas and low spots. Maintain lines, levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.
- B. Remove foreign materials, weeds, and undesirable plants and their roots. Remove contaminated soil.
- C. Scarify subgrade to a depth of 3 inches where topsoil shall be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.
- D. Remove surface debris, roots, vegetation, lumps, and stones in excess of 1 inch.
- E. Obtain ENGINEER's approval of topsoil grade and depth before starting seeding.

3.3 HYDROSEEDING

- A. Seeding with hydroseeder shall be process in which seed, and fertilizer are applied simultaneously in a water slurry via hydraulic seeder.
- B. Hydraulic Seeder: Apply seed, fertilizer, and required amount of water to produce homogenous slurry. The hydraulic seeder shall be equipped with mechanical agitation equipment capable of mixing the materials into a homogeneous slurry and maintaining the slurry in a homogeneous

state until it is applied. The discharge pumps and gun nozzles shall be capable of applying the materials uniformly.

- C. **Volume Certification:** Hydraulic seeding equipment shall have the tank volume certified by a plate prior to the commencement work. This plate shall be affixed in plain view on the hydraulic seeder and shall not be removed or altered. The plate shall certify tank volume only, and shall imply equipment conformance to other requirements of this specification.
- D. **Application of Materials:** Measure the quantity of each material to be charged into the hydraulic seeder tank either by mass or by a system of mass-calibrated volume measurements acceptable to ENGINEER. Add the materials to the tank while it is being loaded with water. Thoroughly mix the materials into a homogeneous water slurry and distribute uniformly over the designated surface area via the hydraulic seeder. Apply seed, fertilizer, within 2 hours of being charged into the hydraulic seeder tank.
- E. Blend into existing, adjacent grass areas to bond new growth to existing, adjacent areas or to previous applications to form uniform surfaces.
- F. Apply fertilizer at rate based on soil analysis by CONTRACTOR and approved by ENGINEER.
- G. Apply seed at a rate of 150 pounds per acre.
- H. Do not seed areas in excess of that which can be mulched on same day.
- I. **Planting Season:** April to September.
- J. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- K. Apply seed when winds do not exceed 5 miles per hour using equipment suitable for area involved.
- L. Measure quantities of material by weight or weight-calibrated volume measurement.

3.4 MULCHING

- A. Immediately following seeding, apply mulch at rate 2,000 pounds per acre. Maintain clear of shrubs and trees.
- B. Apply tackifier-erosion control agent to mulch with hydroseeding equipment immediately after each area has been mulched. Apply tackifier according to manufacturer's recommendations.
- C. Do not permit passage of vehicular traffic or construction equipment on areas mulched and covered with tackifier.

3.5 EROSION CONTROL BLANKET

- A. Immediately following seeding apply erosion control blanket over entire seeded area.
- B. Apply erosion control blanket to prepared and seeded surfaces following manufacturer's requirements and recommendations.

3.6 EROSION CONTROL BLANKET STAPLING

- A. Staple erosion control blanket strictly according to manufacturer's requirements and recommendation.

3.7 OVERLAP

- A. Seeding and mulching, and erosion control blanket shall overlap adjoining vegetation by 12 inches (300 mm).

3.8 MAINTENANCE

- A. Mow grass at regular intervals to maintain at a maximum height of 2 1/2 inches. Do not cut more than one-third of grass blade at any 1 mowing.
- B. Neatly trim edges and hand clip where necessary.
- C. Immediately remove clippings after mowing and trimming.
- D. Water to prevent grass and soil from drying out.
- E. Roll surface to remove minor depressions or irregularities.
- F. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
- G. Immediately reseed areas which show bare spots.
- H. Protect seeded areas with warning signs during maintenance period.
- I. Keep soil moist during germination period; adequately water grassed areas until accepted by ENGINEER.
- J. Apply water to ensure moisture penetration of 3 to 4 inches; control sprinkling to prevent washouts.
- K. Maintain grassed areas free of pests and disease.
- L. Do not apply herbicide when it will cause damage to new grass.
- M. Fertilize seeded areas 1 month after seeding.
- N. Spread fertilizer evenly and water in well. Postpone fertilizing until next spring if application falls within a 4-week period prior to expected end of growing season in locality.

3.9 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Control: Field inspection.
- B. Areas will be accepted by ENGINEER provided that:
 - 1. Seeded areas are properly established.
 - 2. Turf is free of eroded, bare, or dead spots and 98 percent free of weeds.
 - 3. No surface soil is visible when grass has been cut to height of 1 1/2 inches. A minimum coverage of 95 percent is achieved in each seeded area.
 - 4. Seeded areas have been cut at least twice, the last cut being carried out within 24 hours of acceptance.
- C. Areas seeded in the fall will be accepted in the following spring after start of growing season, when acceptance conditions are fulfilled.

3.10 CLEANING

- A. Section 01700 - Contract Closeout: Requirements for cleaning installed work.
- B. Clean up immediately, soil, mulch, broken sod, or other debris spilled onto pavement and dispose of deleterious materials.
- C. Take precautions and prevent contamination by seeding slurry of structures, signs, guardrails, fences, utilities, or other surfaces not specified to be landscaped.
- D. Where contamination occurs, remove seeding slurry to satisfaction of, and by means approved by ENGINEER.

3.11 PROTECTION OF FINISHED WORK

- A. Section 01500 - Construction Facilities and Temporary Controls: Requirements for protecting installed work.
- B. Protect landscaped areas from damage.

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Formwork for cast-in-place concrete with shoring, bracing, and anchorage.
- B. Form accessories.
- C. Form stripping.

1.2 RELATED SECTIONS

- A. Section 03200 - Concrete Reinforcement.
- B. Section 03300 - Cast-in-Place Concrete.

1.3 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. American Concrete Institute (ACI):
 - 1. 301 - Structural Concrete for Buildings.
 - 2. 318 - Building Code Requirements for Reinforced Concrete.
 - 3. 347 - Recommended Practice for Concrete Formwork.
- C. PS 1 - Construction and Industrial Plywood.

1.4 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.
- C. Product Data: Include for void form materials and installation requirements.

1.5 QUALITY ASSURANCE

- A. Perform work of this Section in accordance with ACI 347, 301, and 318.

- B. Immediately remove from Site forms that cannot be properly cleaned or repaired.

1.6 QUALIFICATIONS

- A. Design formwork under direct supervision of a professional structural engineer experienced in design of this work and licensed in State of Ohio.

1.7 REGULATORY REQUIREMENTS

- A. Conform to applicable code for design, fabrication, erection, and removal of formwork.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Material and Equipment: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver void forms and installation instructions in manufacturer's packaging.
- C. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.9 SEQUENCING AND SCHEDULING

- A. Section 01015 - General Requirements: Requirements for coordination.
- B. Coordinate this Section with work of other Sections which require attachment of components to formwork.
- C. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from ENGINEER.

PART 2 PRODUCTS

2.1 DESIGN REQUIREMENTS

- A. Design, engineer, and construct formwork, shoring, and bracing to conform to design and code requirements; resultant concrete shall conform to required shape, line, and dimension.

2.2 WOOD FORM

- A. Form Materials: At the discretion of CONTRACTOR.

2.3 ACCESSORIES

- A. Form Ties: Removable type, metal, adjustable length, cone type, with waterproofing washer, free of defects that could leave holes larger than 1 1/4 inch concrete surface.

- B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture.
- C. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01015 - General Requirements: Verification of existing conditions before starting work.
- B. Verify lines, levels, openings, and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.

3.2 PREPARATION

- A. Obtain approval from ENGINEER for use of earth forms. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.3 ERECTION - FORMWORK

- A. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301 and ACI 347.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to over stressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Obtain approval before framing openings in structural members which are not shown on Drawings.
- F. Provide fillet and chamfer strips on external corners of edges of concrete exposed to view unless otherwise shown on Drawings.
- G. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.
- H. Where forms are to be partially filled, fix wooden strips approved by ENGINEER to form reglets to define limits between successive pours.
- I. Construct forms tight fitting to prevent cement migrating out of plastic matrix.

3.4 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive special finishes which are effected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items which will be cast directly into concrete.
- C. Coordinate with work of other Sections in forming and placing openings, slots, reglets, recesses, brick veneer dovetail slots, sleeves, bolts, anchors, other inserts, and components of other work.

3.6 FORM REMOVAL

- A. Give ENGINEER advance notice prior to form removal.
- B. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and to prevent damage to corners and edges.
- C. Use 4 days minimum times, from time of placement of concrete to concrete formwork removal, provided the curing requirements of ACI 301 are followed:
- D. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- E. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

3.7 TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 301.

3.8 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Control: Field inspection and testing.
- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

- C. Do not reuse wood formwork more than 5 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.9 CLEANING

- A. Section 01700 - Contract Closeout: Requirements for cleaning installed work.
- B. Clean forms as erection proceeds, to remove foreign matter within forms.
- C. Clean formed cavities of debris prior to placing concrete.
- D. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through cleanout ports.
- E. During cold weather remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Reinforcing steel bars, wire fabric, and accessories for cast-in-place concrete.

1.2 RELATED SECTIONS

- A. Section 03100 - Concrete Formwork.
- B. Section 03300 - Cast-in-Place Concrete.

1.3 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. American Concrete Institute (ACI):
 - 1. SP-66 - Detailing Manual.
 - 2. 301 - Structural Concrete for Buildings.
 - 3. 315 - Details and Detailing of Concrete Reinforcement.
 - 4. 318 - Building Code Requirements for Reinforced Concrete.
- C. American Society for Testing and Materials (ASTM):
 - 1. A82 - Standard Specification for Cold Drawn Steel Wire for Concrete Reinforcement.
 - 2. A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
 - 3. A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- D. Concrete Reinforcing Steel Institute (CRSI):
 - 1. 63 - Recommended Practice for Placing Reinforcing Bars.
 - 2. 65 - Recommended Practice for Placing Bar Supports, Specifications, and Nomenclature.
 - 3. Manual of Practice.

1.4 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Shop Drawings:
 - 1. Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices with identifying code marks to permit correct placement without reference to Drawings in accordance with ACI 315.
 - 2. Detail placement of reinforcing where special conditions occur.
 - 3. Design and detail lap lengths and bar development lengths in accordance with ACI 318.
- C. Test Reports: Submit certified copies of mill test report of reinforcement materials analysis without rolled-in grade marks.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform work of this Section in accordance with ACI 301, ACI SP-66, and ACI 318.
- B. Remove immediately from Site reinforcement without rolled-in grade marks or certified mill test reports.

1.6 QUALIFICATIONS

- A. Design reinforcement under direct supervision of a professional structural engineer experienced in design of this work and licensed in State of Ohio.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Material and Equipment: Requirements for transporting, handling, storing, and protecting products.
- B. Store reinforcement in bundles with identifying tags or markings on racks or sills that will permit easy access for identification and handling and prevent it from becoming coated with any material that would adversely affect the bond.
- C. Maintain individual bar identification after bundles are broken.

1.8 SEQUENCING AND SCHEDULING

- A. Section 01015 - General Requirements: Requirements for coordination.

- B. Coordinate with placement of formwork, formed openings, and other work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, 40 ksi yield grade; billet steel bars.
- B. Welded Steel Wire Fabric: ASTM A497 Welded deformed type; in flat sheets; coiled rolls; unfinished.

2.2 ACCESSORIES

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.
- C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Stainless steel.

2.3 FABRICATION

- A. Fabricate concrete reinforcing in accordance with ACI SP-66.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01015 - General Requirements: Verification of existing conditions before starting work.

3.2 PLACEMENT

- A. Install reinforcement as shown on Drawings and in accordance with reviewed Shop Drawings.
- B. Comply with ACI 315 for reinforcement installation not shown on Drawings.
- C. Comply with ACI 315 and CRSI 65 for bar support systems and patterns.
- D. Make only those splices shown on Drawings with lengths in accordance with ACI 318.
- E. Place, support, and secure reinforcement against displacement. Do not deviate from required position.
- F. Do not displace or damage vapor barrier.

- G. Accommodate placement of formed openings.
- H. Notify ENGINEER at least 24 hours in advance of completion of reinforcement placing to permit time for inspection, final adjustment, and review by ENGINEER prior to placing concrete.

3.3 OBSTRUCTIONS

- A. In the event conduits, piping, inserts, sleeves, or other items interfere with reinforcement placing, immediately notify ENGINEER and obtain approval from ENGINEER for adjustments.
- B. Do not cut bars to clear obstructions without consulting ENGINEER.

3.4 FIELD BENDING

- A. Do not field bend reinforcement except as authorized by ENGINEER.
- B. When field bending is authorized, bend without heat, applying a slow and steady pressure.
- C. Replace bars which develop cracks or splits.

3.5 TOLERANCES

- A. Unless specified otherwise, reinforcing steel spacing shall not vary by more than 1/2 inch from dimensions shown on Drawings.

3.6 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Control: Field inspection and testing.
- B. Inspect for acceptability and conformance with spacing requirements as shown on the Drawings.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. *Cast-in-place concrete for equipment decontamination pad and electrical panel post footing.*

1.2 RELATED SECTIONS

- A. Section 02222 - Excavating.
- B. Section 03100 - Concrete Formwork: Formwork and accessories.
- C. Section 03200 - Concrete Reinforcement.

1.3 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. American Concrete Institute (ACI):
 - 1. 211.1 - Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
 - 2. 301 - Structural Concrete for Buildings.
 - 3. 302 - Guide for Concrete Floor and Slab Construction.
 - 4. 304 - Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
 - 5. 305R - Hot Weather Concreting.
 - 6. 306R - Cold Weather Concreting.
 - 7. 308 - Standard Practice for Curing Concrete.
 - 8. 318 - Building Code Requirements for Reinforced Concrete.
- C. American Society for Testing and Materials (ASTM):
 - 1. C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - 2. C33 - Standard Specification for Concrete Aggregates.
 - 3. C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 4. C94 - Standard Specification for Ready-Mixed Concrete.

5. C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
6. C150 - Standard Specification for Portland Cement.
7. C172 - Standard Practice for Sampling Freshly Mixed Concrete.
8. C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
9. C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
10. C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
11. E329 - Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

D. National Ready Mixed Concrete Association (NRMCA).

1.4 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Concrete Mix Investigation Data: Submit mix data minimum 14 days prior to producing concrete.
- C. Source Data: Prior to aggregate production, submit details of source and methods proposed for producing aggregate.
- D. Test Reports: If required, submit, minimum 14 days prior to intended use, test reports of current representative samples of the following materials: coarse aggregate, fine aggregate, water, cement.
- E. Certificates: Certify that mix proportions meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform work of this Section in accordance with ACI 301.
- B. Acquire cement and aggregate from same source for all work.
- C. Conform to ACI 305R when concreting during hot weather.
- D. Conform to ACI 306R when concreting during cold weather.

1.6 QUALIFICATIONS

A. Supplier:

1. Certified ready-mix supplier approved by ENGINEER.
2. Plant certification complying with NRMCA.

B. Testing Agency: Independent testing laboratory complying with ASTM E329 and approved by ENGINEER, to carry out trial concrete mix investigations, and select materials and mix proportions in accordance with ACI 211.1.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01500 - Construction Facilities and Temporary Controls: Requirements for temporary controls.

B. Cold Weather Requirements:

1. Apply when the air temperature is below 40 degrees F.
2. Submit to ENGINEER for review proposed equipment and methods before concreting in cold weather.
3. Use steam at a low pressure or vented-type portable heaters to provide a suitable temperature above 40 degrees F for placing concrete. Protect concrete by blocked up heaters from local concentrations of heat. Do not use Salamander type heaters.

C. Hot Weather Requirements:

1. Apply when the air temperature is above 78 degrees F.
2. Submit to ENGINEER for review proposed equipment and methods before concreting in hot weather.

D. Concrete Temperature Upon Delivery to Site: Between 60 and 80 degrees F.

1.8 SEQUENCING AND SCHEDULING

A. Section 01015 - General Requirements: Requirements for coordination.

B. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: ASTM C150 Type I, normal Portland Type.

- B. Fine and Coarse Aggregates: ASTM C33.

2.2 ADMIXTURES

- A. Air Entrainment: ASTM C260.

2.3 CONCRETE MIX

- A. Mix concrete in accordance with ACI 304. Deliver concrete in accordance with ASTM C94.
- B. Provide concrete to the following criteria:

<i>Unit</i>	<i>Measurement</i>
Compressive Strength (28-day)	4000 psi
Water/Cement Ratio (maximum)	0.45 by weight
Aggregate Size (maximum)	3/4 inch
Air Entrained	6 percent
Slump - Plus or minus 1 inch (25 mm)	3 inches
Cement Content (minimum)	600 pounds per cu yd

- C. Use accelerating admixtures in cold weather only when approved by ENGINEER. Use of admixtures will not relax cold weather placement requirements.
- D. Do not use calcium chloride.
- E. Use set retarding admixtures during hot weather only when approved by ENGINEER.
- F. Add air entraining agent to normal weight concrete mix for work exposed to exterior.

2.4 SOURCE QUALITY CONTROL

- A. Section 01400 - Quality Control: Requirements for source testing and analysis of concrete materials.
- B. ENGINEER may perform tests of cement, aggregates, water, and the mixture thereof at batch plant to ensure conformance with specified requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01015 - General Requirements: Verification of existing conditions before starting work.
- B. Verify requirements for concrete cover over reinforcement.

- C. Verify that anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.2 PREPARATION

- A. In locations where new concrete is to be placed on grade; prepare subgrade in order to receive concrete.

3.3 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301.
- B. Notify ENGINEER minimum 24 hours prior to commencement of concrete placing operations to allow ENGINEER opportunity to review methods of conveying, spreading, consolidating, finishing, curing, and protecting concrete.
- C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, brick veneer dovetail slots, and waterstops are not disturbed during concrete placement.
- D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- E. Place concrete continuously expansion, control, and construction joints.
- F. Do not interrupt successive placement; do not permit cold joints to occur.

3.4 CONCRETE FINISHING

- A. Finish concrete surfaces in accordance with ACI 308.

3.5 CURING AND PROTECTION

- A. Cure and protect concrete in accordance with ACI 308.
- B. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- D. Ponding: Maintain 100 percent coverage of water over slab areas continuously for 4 days.
- E. Spraying: Spray water over slab areas and maintain wet for 7 days.

3.6 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Control: Field inspection and testing.

- B. Three concrete test cylinders will be taken by ENGINEER for every 75 or less cu yd of concrete placed each day.
- C. One additional test cylinder will be taken by ENGINEER during cold weather concreting, cured on job site under same conditions as concrete it represents.
- D. One slump test will be taken for each set of test cylinders taken.
- E. Testing by ENGINEER or failure to detect defective work will not prevent rejection when defect is discovered, nor will it obligate TRUST for final acceptance.
- F. Methods of Testing by ENGINEER:
 - 1. Securing Composite Samples: ASTM C172.
 - 2. Molding and Securing Specimens from Each Sample: ASTM C31.
 - 3. Compressive Strength: ASTM C39 except as follows:
 - 1. Specimens will be tested at 7 and 28 days.
 - 4. Slump for Each Strength Test: ASTM C143.
 - 5. Total Air Content for Each Strength Test: ASTM C231 or ASTM C173, as determined by ENGINEER.
 - 6. Temperature of concrete sample and mixing water for each strength test or as required.
- G. Copies of test reports will be supplied to CONTRACTOR on request.

3.7 PROTECTION OF FINISHED WORK

- A. Section 01500 - Construction Facilities and Temporary Controls: Requirements for protecting installed work.
- B. Do not permit traffic over unprotected floor surface.

END OF SECTION

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Design, supply and install electrical power control panel and connections in conduit system between local electrical utility connection and containment cell manhole with remote pump shutoff controls.
- B. Electrical power for trailers and site services during construction.
- C. Leachate pumping system with associated piping.
- D. Discharge hose enclosure.

1.2 RELATED SECTIONS

- A. Section 01500 - Construction Facilities and Temporary Controls.
- B. Section 02223 - Backfilling.

1.3 REFERENCES

- A. Section 01400 - Quality Control: Requirements for references.
- B. National Electrical Manufacturers Association (NEMA).
- C. National Fire Protection Agency (NFPA): 70 - National Electrical Code.
- D. Underwriters Laboratories Inc. (UL).

1.4 SUBMITTALS

- A. Section 01300 - Submittals: Requirements for submittals.
- B. Code Compliance: Copies of required permits and inspection certificates or other code compliance documents from code enforcement authorities.
- C. Record Documents: Include a complete set of marked-up "as-built" drawings of schematics, interconnection, underground conduits, and 1-line diagrams. Reserve as-built drawings for complete record of work actually installed and update as work is completed. Make notations neat and legible. Make drawings available to ENGINEER at Site at all times.
- D. Acceptance Tests: Provide copies of test results upon successful completion of work of this Section.

1.5 QUALITY ASSURANCE

- A. Perform work of this Section in accordance with state authority and Public Works standards.
- B. Apply for, obtain, and pay for third inspection certificates.
- C. Materials and devices, except items not covered by existing UL standards, shall bear UL labels.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Material and Equipment: Requirements for transporting, handling, storing, and protecting products.
- B. Store electrical equipment and supplies in dry locations to prevent damage to materials and to protect such equipment from extremes in temperature, moisture, and physical harm.

PART 2 PRODUCTS

2.1 MATERIAL AND EQUIPMENT - GENERAL REQUIREMENTS

- A. New, of standard products of manufacturers regularly engaged in the production of such equipment, and the manufacturer's latest standard design.
- B. Where materials, equipment, apparatus, or other products are specified by manufacturer, brand name, type, or catalog number, such designation is for the purpose of establishing a standard of desired quality and style.
- C. Material of the same type or classification and used for the same purpose shall be from the same manufacturer.
- D. UL approved unless otherwise approved by ENGINEER. Mark on each piece of equipment installed the name of trademark of the manufacturer and the rating in volts and amperes where it can be readily observed.

2.2 WIRE AND CABLE

- A. Wire: UL labeled, conforming to NEMA and NFPA 70.
- B. Conductors: Copper.
- C. Splices: Crimped, with heat shrink protection. Use only for pull boxes.
- D. Wiring Conductors: Stranded.
- E. Wire Smaller Than 12 AWG: Use only for control systems. Minimum AC control wire: 14 AWG.

F. Color code wire and cable as follows:

1. Power: Black.
2. Lighting:
 1. White, Neutral: Grounding conductor.
 2. Red, Black, Blue: Ungrounded conductor.
3. Equipment Grounding: Green.
4. AC Control Wiring: Red.
5. DC Wiring: Blue.
6. Interlock Control Circuit: Yellow.

G. Instrumentation Wire: Twisted, shielded pair, Beldon 8762.

2.3 WIRE MARKERS

- A. Colored, lettered, and numbered, gummed type, impregnated, plastic coated, Brady No. E-500, all-temperature.

2.4 WARNING TAPE

- A. Plastic magnetic type, 6-inch wide, 5-mil composition film consisting of metalized foil laminated between 2 layers of inert plastic film suitable for prolonged use underground, yellow in color, with a continuously repeated message in permanent ink warning of buried electric and/or telephone lines; Terratape, "detectable" type.

2.5 WIRE CONNECTIONS

- A. Secure control wire and cable terminations, taps, and splices with solderless pressure type connectors using a ratchet-type crimping tool.
- B. At screw-type connection points use Thomas & Betts or Burndy connectors.

2.6 ELECTRIC SUBMERSIBLE PUMP

- A. Electric submersible effluent pump Goulds model 3885 WE15HH, 1 1/2 Hp, 3 phase, 460 volts with 2-inch discharge.

2.7 DISCHARGE PIPING

- A. Steel pipe, Schedule 40, ASTM A53, galvanized.

- B. Fiber reinforced PVC discharge hose, 2-inch diameter type lay flat, New Age Industries.

2.8 DISCHARGE HOSE ENCLOSURE

- A. Metal fabricated, steel enclosure, equipped with locking devise.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01015 - General Requirements: Verification of existing conditions before starting work.
- B. ENGINEER may change the location of wiring if the new location is within a maximum 10-foot radius of original location. Provide changes at no extra cost if required before installation in the original locations.

3.2 PREPARATION

- A. Protect materials before and after installation against moisture, dirt, and damage.
- B. Keep Site clear of undue accumulation of rubbish at all times.
- C. Thoroughly clean equipment and fixtures and leave in a satisfactory condition for use.

3.3 WIRE AND CABLE INSTALLATION

- A. Size and install branch wiring so that the voltage drop does not exceed 3 percent from the panels to the farthest outlet at full load. Do not connect circuits sharing a common neutral to the same main phase.
- B. Install wiring in conduit systems to outlet boxes by using approved methods, lubricants, and pull tension.
- C. As far as practicable, make feeder cables continuous from origin to panel termination at containment cell manhole, without running splices in intermediate pull boxes or splicing chambers except as specified in this Section. Leave sufficient slack at the termination to make proper connection.
- D. Do not pull splices into conduit or place so as to be inaccessible.
- E. Identify wiring for systems and controls on each end by a circuit or wire number using Brady wire wrap markers.
- F. Lugs, terminals, and screws used for termination of wiring shall be suitable for copper conductors.

- G. Identify wiring with permanent indelible identifying markings, either numbered or colored plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- H. Maintain phase sequence and color coding throughout.
- I. Prior to pulling in conductors, ensure conduits are complete, properly swabbed, and moisture free. Install nylon pull wire in conduits to facilitate future cable pulling by others.
- J. Designate conductors by circuit number and phase at each terminal or splice location. Do not allow splices between pull boxes. Strip conductor ends of insulation without nicking metal. Make connections high-conductive and permanent.

3.4 GROUNDING

- A. Provide grounding in accordance with NFPA 70. Run ground wires continuous.
- B. Provide equipment grounding as required regardless of whether shown on Drawings or specified in this Section.
- C. Arrange grounds so that under normal operating conditions no injurious amount of current will flow in any grounding conductor.
- D. Ground conduit systems and control circuits. Make ground connection to conduit and wiring at the electrical panel.
- E. Run a separate ground conductor in each branch or feeder conduit.
- F. Thoroughly clean grounding surfaces before applying ground connections. Ground conduit directly or through equipment frames and ground busses to the ground system.
- G. Make ground wire splices and taps by exothermic welds or approved compression type fittings.
- H. Ground Wire Sizes: NFPA 70.
- I. Thoroughly clean and polish contact surfaces before making connections to insure good electrical contact.

3.5 LABELING AND IDENTIFICATION

- A. Mark circuits at circuit junction boxes and pull boxes. Identify conductors by circuit number and phase at each terminal or splice location. Use gummed Brady E-500 all-temperature, impregnated, plastic coated, markers.
- B. Ensure manufacturers' nameplates and labels are visible and legible after equipment is installed.
- C. Provide warning signs as specified or to meet TRUST's requirements.

3.6 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Control: Field inspection and testing.
- B. On completion, thoroughly test the installation and wiring using a qualified electrician to determine proper polarity, phasing, freedom from grounds and short circuits, continuity, and operation of equipment, meters, relays, and instruments.
- C. Incorporate complete test and inspection records into a report for submittal to ENGINEER. Record all readings taken.
- D. Perform tests in the presence of ENGINEER. Notify ENGINEER at least 24 hours in advance of proposed tests.
- E. Schedule tests with approval of ENGINEER. Do not perform or schedule testing of any kind without ENGINEER's approval.
- F. Obtain ENGINEER's approval prior to performing work on an energized circuit. Do not interrupt energized circuits without ENGINEER's previous approval.
- G. Furnish instruments and personnel required for tests.
- H. Provide assistance for inspection to ENGINEER, and state or local permit inspectors at all times as requested. Remove covers, operate machinery, and conduct continuity tests as necessary to demonstrate quality and adequacy.
- I. Test operate electrical equipment including service entrance unit, branch feeder, panelboard circuit, control system, and electrical control on installed mechanical equipment as requested.
- J. Test cables and equipment for grounds and shorts using a Megger insulation testing instrument, which shall impress a voltage of not less than 500 volts DC upon the circuit under test. Resistance of wire and cable insulation shall not be less than 1,000,000 ohms. Where tests indicate that insulation was damaged by handling or during installation, install new cable.
- K. Set breakers and relays as directed by ENGINEER so that equipment will be in proper operating condition before being placed in service.
- L. Provide personnel, instruments, meters, and equipment as needed to work with ENGINEER for checking operation of equipment.
- M. Check calibration of level of each measuring system at a minimum of 5 points in their span. This may be done outside of the installation with probes and electronics kept matched.
- N. Check calibration of each flow computer by simulating input signals to electronics and checking outputs.

3.7 INSTALLATION OF ELECTRICAL SUBMERSIBLE PUMP AND ACCESSORIES

- A. Install pump, pipe, fittings, discharge hose enclosure accounting to lines and dimensions shown on Drawings.

- B. Supply 2-inch diameter leachate discharge hose equipped with quick disconnect fittings.

END OF SECTION

APPENDIX A
CONTAMINANT PROFILE

TABLE 1
CONTAMINANT PROFILE FOR
COMMERCIAL OIL SERVICES SITE
LAGOON SLUDGE SAMPLES

<i>Constituent</i>	<i>Frequency</i>	<i>Range of Detected Concentrations</i>
<u>Volatiles (VOCs) (mg/kg)</u>		
1,1,1-Trichloroethane	4/12	7.3 - E(140)
1,1-Dichloroethane	8/13	6.9 - E(200)
1,1-Dichloroethene	1/13	40
Acetone	2/12	0.23 - 210
Benzene	8/12	J(6.4) - 26
Chlorobenzene	2/14	11 - 13
Chloroform	3/12	BJ(6.5) - B(26)
Dibromochloromethane	1/14	9.9
Ethylbenzene	12/14	J(3.6) - 79
Methylene Chloride	9/13	B(0.007) - J(52)
Styrene	1/13	15
t-1,2-Dichloroethene	8/14	43 - E(800)
Tetrachloroethene	8/12	J(1.7) - J(150)
Toluene	14/14	J(0.003) - 480
Trichloroethene	8/13	7.8 - E(23000)
Vinyl Chloride	2/12	18 - 42
Xylenes	13/14	J(0.004) - 560

TABLE 1
CONTAMINANT PROFILE FOR
COMMERCIAL OIL SERVICES SITE
LAGOON SLUDGE SAMPLES

<i>Constituent</i>	<i>Frequency</i>	<i>Range of Detected Concentrations</i>
<u><i>Semi-volatiles (SVOCs) (mg/kg)</i></u>		
1,2-Dichlorobenzene	2/23	J(13) - J(16)
2,4,5-Trichlorophenol	1/23	3800
2,4-Dimethylphenol	7/22	J(34) - J(200)
2-Methylnaphthalene	22/23	D(12) - 3000
2-Methylphenol	11/23	J(9.3) - J(450)
2-Nitroaniline	1/23	150
4-Chloro-3-Methylphenol	2/23	DJ(3.9) - J(18)
4-Methylphenol	16/22	D(24) - 1400
Acenaphthene	11/20	J(5.5) - J(180)
Acenaphthylene	4/23	D(2.7) - J(270)
Anthracene	13/21	D(2.2) - J(340)
Benz(a)anthracene	21/22	DJ(5.8) - 770
Benzo(a)pyrene	21/22	DJ(1.7) - 540
Benzo(b)fluoranthene	16/22	J(11) - 600
Benzo(g,h,i)perylene	14/21	DJ(2.5) - J(310)
Benzo(k)fluoranthene	2/23	DJ(6.1) - D(8.2)
bis-(2-ethylhexyl)phthalate	22/22	BD(37) - B(2900)
Butylbenzylphthalate	7/23	J(11) - J(140)
Chrysene	20/21	D24 - 1600
Di-n-butylphthalate	4/14	BD(1.6) - U(780)
Di-n-octylphthalate	3/23	D(2.8) - J(67)
Dibenz(a,h)anthracene	10/19	J(6.8) - 200
Dibenzofuran	11/21	J(7.6) - J(280)
Diethylphthalate	1/23	40
Fluoranthene	19/20	DJ(9.7) - 810
Fluorene	21/22	DJ(5.3) - 420
Indeno (1,2,3-cd)pyrene	6/22	J(13) - 180
N-Nitrosodiphenylamine	2/23	J(67)
Naphthalene	20/21	D(10) - 6700
Phenanthrene	20/21	D(40) - 3500
Phenol	14/18	DJ(3.4) - 1400
Pyrene	22/23	DJ(18) - 1600

TABLE 1
CONTAMINANT PROFILE FOR
COMMERCIAL OIL SERVICES SITE
LAGOON SLUDGE SAMPLES

<i>Constituent</i>	<i>Frequency</i>	<i>Range of Detected Concentrations</i>
<u>Metals (mg/kg)</u>		
Aluminum	22/22	272 - 12700
Antimony	3/20	J(15) - 55.8
Arsenic	14/20	B(2.3) - 40.5
Barium	22/22	46.1 - 1260
Beryllium	19/19	0.49 - 43.9
Cadmium	6/21	0.33 - 5.4
Calcium	22/22	457 - 105000
Chromium	22/22	16.6 - 1610
Cobalt	19/19	3.8 - 26.5
Copper	22/22	19.8 - J(4900)
Iron	22/22	459 - J(33000)
Lead	20/20	77.8 - 7780
Magnesium	22/22	194 - 26000
Manganese	22/22	5.7 - J(467)
Mercury	14/22	0.04 - J(1.2)
Nickel	22/22	2.8 - 148
Potassium	17/18	225 - 3010
Selenium	3/19	2.9 - J(3.9)
Sodium	18/18	84.7 - 4540
Thallium	1/18	B(5.8)
Vanadium	20/21	1.1 - 30.8
Zinc	20/20	J(59.6) - J(2050)

Notes:

B - Detected in the blank, result not corrected.

D - Sample diluted for this analyte.

J - Detected at less than detection limit.

E - Estimated result because of the presence of interference.

U - Unconfirmed - second column not requested.

APPENDIX B
USEPA METHODS 5 AND 25

METHOD 25-DETERMINATION OF TOTAL GASEOUS NONMETHANE ORGANIC EMISSIONS AS CARBON

1. Applicability and Principle

1.1 Applicability. This method applies to the measurement of volatile organic compounds (VOC) as total gaseous nonmethane organics (TGNMO) as carbon in source emissions. Organic particulate matter will interfere with the analysis and, therefore, a particulate filter is required. The minimum detectable for the method is 50 ppm as carbon.

When carbon dioxide (CO₂) and water vapor are present together in the stack, they can produce a positive bias in the sample.

The magnitude of the bias depends on the concentrations of CO₂ and water vapor. As a guideline, multiply the CO₂ concentration, expressed as volume percent, times the water vapor concentration.

If this product does not exceed 100, the bias can be considered insignificant. For example, the bias is not significant for a source having 10 percent CO₂ and 10 percent water vapor, but it would be significant for a source near the detection limit having 10 percent CO₂ and 20 percent water vapor.

This method is not the only method that applies to the measurement of TGNMO. Costs, logistics, and other practicalities of source testing may make other test methods more desirable for measuring VOC contents of certain effluent streams. Proper judgment is required in determining the most applicable VOC test method.

For example, depending upon the molecular weight of the organics in the effluent stream, a totally automated semicontinuous nonmethane organics (NMO) analyzer interfaced directly to the source may yield accurate results. This approach has the advantage of providing emission data semicontinuously over an extended time period.

Direct measurement of an effluent with a flame ionization detector (FID) analyzer may be appropriate with prior characterization of the gas stream and knowledge that the detector responds predictably to the organic compounds in the stream. If present, methane (CH₄) will, of course, also be measured. The FID can be applied to the determination of the mass concentration of the total molecular structure of the organic emissions under any of the following limited conditions:

(1) Where only one compound is known to exist; (2) when the organic compounds consist of only hydrogen and carbon; (3) where the relative percentages of the compounds are known or can be determined, and the FID responses to the compounds are known; (4) where a consistent mixture of the compounds exists before and after emission control and only the relative concentrations are to be assessed; or (5) where the FID can be calibrated against mass standards of the compounds emitted (solvent emissions, for example).

Another example of the use of a direct FID is as a screening method. If there is enough information available to provide a rough estimate of the analyzer accuracy, the FID analyzer can be used to determine the VOC content of an uncharacterized gas stream. With a sufficient buffer to account for possible inaccuracies, the direct FID can be a useful tool to obtain the desired results without costly exact determination.

In situations where a qualitative/quantitative analysis of an effluent stream is desired or required, a gas chromatographic FID system may apply. However, for sources emitting numerous organics, the time and expense of this approach will be formidable.

1.2 Principle. An emission sample is withdrawn from the stack at a constant rate through a heated filter and a chilled condensate trap by means of an evacuated sample tank. After sampling is completed, the TGNMO are determined by independently analyzing the condensate trap and sample tank fractions and combining the analytical results. The organic content of the condensate trap fraction is determined by oxidizing the NMO to CO₂ and quantitatively collecting the effluent in an evacuated vessel; then a portion of the CO₂ is reduced to CH₄ and measured by an FID. The organic content of the sample tank fraction is measured by injecting a portion of the sample into a gas chromatographic column to separate the NMO from carbon monoxide (CO), CO₂, and CH₄; the NMO are oxidized to CO₂, reduced to CH₄, and measured by an FID. In this manner, the variable response of the FID associated with different types of organics is eliminated.

2. Apparatus

2.1 Sampling. The sampling system consists of a heated probe, heated filter, condensate trap, flow control system, and sample tank (Figure 25-1). The TGNMO sampling equipment can be constructed from commercially available components and components fabricated in a machine shop. The following equipment is required:

2.1.1 Heated Probe. 6.4-mm (1/4-in.) OD stainless steel tubing with a heating system capable of maintaining a gas temperature at the exit end of at least 129 °C (265 °F). The probe shall be equipped with a thermocouple at the exit end to monitor the gas temperature.

A suitable probe is shown in Figure 25-1. The nozzle is an elbow fitting attached to the front end of the probe while the thermocouple is inserted in the side arm of a tee fitting attached to the rear of the probe. The probe is wrapped with a suitable length of high temperature heating tape, and then covered with two layers of glass cloth insulation and one layer of aluminum foil.

Note.-If it is not possible to use a heating system for safety reasons, an unheated system with an in-stack filter is a suitable alternative.

2.1.2 Filter Holder. 25-mm (15/16-in.) ID Gelman filter holder with stainless steel body and stainless steel support screen with the Viton O-ring replaced by a Teflon O-ring.

Note.-Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

2.1.3 Filter Heating System. A metal box consisting of an inner and an outer shell separated by insulating material with a heating element in the inner shell capable of maintaining a gas temperature at the filter of 121 ± 3 °C (250 ± 5 °F).

A suitable heating box is shown in Figure 25-2. The outer shell is a metal box that measures 102 mm*280 mm*292 mm (4 in.*11 in.*11 1/2 in.), while the inner shell is a metal box measuring 76 mm*229 mm*241 mm (3 in.*9 in.*9 1/2 in.). The inner box is supported by 13-mm (1/2-in.) phenolic rods. The void space between the boxes is filled with fiberfrax insulation which is sealed in place by means of a silicon rubber bead around the upper sides of the box. A removable lid made in a similar manner, with a 25-mm (1-in.) gap between the parts, is used to cover the heating chamber.

The inner box is heated with a 250-watt cartridge heater, shielded by a stainless steel shroud. The heater is regulated by a thermostatic temperature controller which is set to maintain a temperature of 121 °C as measured by a thermocouple in the gas line just before the filter. An additional thermocouple is used to monitor the temperature of the gas behind the filter.

2.1.4 Condensate Trap. 9.5-mm (3/8-in.) OD 316 stainless steel tubing bent into a U-shape. Exact dimensions are shown in Figure 25-3. The tubing shall be packed with coarse quartz wool, to a density of approximately 0.11 g/cc before

bending.

While the condensate trap is packed with dry ice in the Dewar, an ice bridge may form between the arms of the condensate trap making it difficult to remove the condensate trap. This problem can be prevented by attaching a steel plate between the arms of the condensate trap in the same plane as the arms to completely fill the intervening space.

2.1.5 Valve. Stainless steel shut-off valve for starting and stopping sample flow.

2.1.6 Metering Valve. Stainless steel control valve for regulating the sample flow rate through the sample train.

2.1.7 Rotameter. Glass tube with stainless steel fittings, capable of measuring sample flow in the range of 60 to 100 cc/min.

2.1.8 Sample Tank. Stainless steel or aluminum tank with a minimum volume of 4 liters.

2.1.9 Mercury Manometer or Absolute Pressure Gauge. Capable of measuring pressure to within 1 mm Hg in the range of 0 to 900 mm.

2.1.10 Vacuum Pump. Capable of evacuating to an absolute pressure of 10 mm Hg.

2.2. Condensate Recovery Apparatus. The system for the recovery of the organics captured in the condensate trap consists of a heat source, oxidation catalyst, nondispersive infrared (NDIR) analyzer and an intermediate collection vessel (ICV). Figure 25-4 is a schematic of a typical system. The system shall be capable of proper oxidation and recovery, as specified in Section 5.1. The following major components are required:

2.2.1. Heat Source. Sufficient to heat the condensate trap (including connecting tubing) to a temperature of 200 °C. A system using both a heat gun and an electric tube furnace is recommended.

2.2.2. Heat Tape. Sufficient to heat the connecting tubing between the water trap and the oxidation catalyst to 100 °C.

2.2.3. Oxidation Catalyst. A suitable length of 9.5-mm (3/8-in.) OD Inconel 600 tubing packed with 15 cm (6 in.) of 3.2-mm (1/8-in.) diameter 19 percent

chromia on alumina pellets.

The catalyst material is packed in the center of the catalyst tube with quartz wool packed on either end to hold it in place.

The catalyst tube shall be mounted vertically in a 650 °C tube furnace.

2.2.4 Water Trap. Leak proof, capable of removing moisture from the gas stream.

2.2.5 Syringe Port. A 6.4-mm (1/4-in.) OD stainless steel tee fitting with a rubber septum placed in the side arm.

2.2.6 NDIR Detector. Capable of indicating CO₂ concentration in the range of zero to 5 percent, to monitor the progress of combustion of the organic compounds from the condensate trap.

2.2.7 Flow-Control Valve. Stainless steel, to maintain the trap conditioning system near atmospheric pressure.

2.2.8 Intermediate Collection Vessel. Stainless steel or aluminum, equipped with a female quick connect. Tanks with nominal volumes of at least 6 liters are recommended.

2.2.9 Mercury Manometer or Absolute Pressure Gauge. Capable of measuring pressure to within 1 mm Hg in the range of 0 to 900 mm.

2.2.10 Syringe. 10-ml gas-tight, glass syringe equipped with an appropriate needle.

2.3 NMO Analyzer. The NMO analyzer is a gas chromatograph (GC) with backflush capability for NMO analysis and is equipped with an oxidation catalyst, reduction catalyst, and FID. Figures 25-5 and 25-6 are schematics of a typical NMO analyzer. This semicontinuous GC/FID analyzer shall be capable of: (1) Separating CO, CO₂, and CH₄ from NMO, (2) reducing the CO₂ to CH₄ and quantifying as CH₄, and (3) oxidizing the NMO to CO₂, reducing the CO₂ to CH₄ and quantifying as CH₄, according to Section 5.2. The analyzer consists of the following major components:

2.3.1 Oxidation Catalyst. A suitable length of 9.5-mm (3/8-in.) OD Inconel 600 tubing packed with 5.1 cm (2 in.) of 19 percent chromia on 3.2-mm (1/8-in.) alumina pellets. The catalyst material is packed in the center of the tube supported on either side by quartz wool. The catalyst tube must be mounted vertically in a

650 °C furnace.

2.3.2 Reduction Catalyst. A 7.6-cm (3-in.) length of 6.4-mm (1/4-in.) OD Inconel tubing fully packed with 100-mesh pure nickel powder. The catalyst tube must be mounted vertically in a 400 °C furnace.

2.3.3 Separation Column(s). A 30-cm (1-ft) length of 3.2-mm (1/8-in.) OD stainless steel tubing packed with 60/80 mesh Unibeads 1S followed by a 61-cm (2-ft) length of 3.2-mm (1/8-in.) OD stainless steel tubing packed with 60/80 mesh Carbosieve G. The Carbosieve and Unibeads columns must be baked separately at 200 °C with carrier gas flowing through them for 24 hours before initial use.

2.3.4 Sample Injection System. A 10-port GC sample injection valve fitted with a sample loop properly sized to interface with the NMO analyzer (1-cc loop recommended).

2.3.5 FID. An FID meeting the following specifications is required:

2.3.5.1 Linearity. A linear response (± 5 percent) over the operating range as demonstrated by the procedures established in Section 5.2.3.

2.3.5.2 Range. A full scale range of 10 to 50,000 ppm CH₄.

Signal attenuators shall be available to produce a minimum signal response of 10 percent of full scale.

2.3.6 Data Recording System. Analog strip chart recorder or digital integration system compatible with the FID for permanently recording the analytical results.

2.4 Other Analysis Apparatus.

2.4.1 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 1 mm Hg.

2.4.2 Thermometer. Capable of measuring the laboratory temperature to within 1°C.

2.4.3 Vacuum Pump. Capable of evacuating to an absolute pressure of 10 mm Hg.

2.4.4 Syringes. 10- μ l and 50- μ l liquid injection syringes.

2.4.5 Liquid Sample Injection Unit. 316 SS U-tube fitted with an injection

septum, see Figure 25-7.

3. Reagents

3.1 Sampling. The following are required for sampling: 3.1.1 Crushed Dry Ice.

3.1.2 Coarse Quartz Wool. 8 to 15 μ m.

3.1.3 Filters. Glass fiber filters, without organic binder.

3.2 NMO Analysis. The following gases are needed: 3.2.1 Carrier Gases. Zero grade helium (He) and oxygen (O₂ containing less than 1 ppm CO₂ and less than 0.1 ppm C as hydrocarbon.

3.2.2 Fuel Gas. Zero grade hydrogen (H₂), 99.999 percent pure.

3.2.3 Combustion Gas. Zero grade air or O₂ as required by the detector.

3.3 Condensate Analysis. The following gases are needed: 3.3.1 Carrier Gas. Zero grade air, containing less than 1 ppm C.

3.3.2 Auxiliary O₂. Zero grade O₂, containing less than 1 ppm C.

3.3.3 Hexane. ACS grade, for liquid injection.

3.3.4 Decane. ACS grade, for liquid injection.

3.4 Calibration. For all calibration gases, the manufacturer must recommend a maximum shelf life for each cylinder (i.e., the length of time the gas concentration is not expected to change more than ± 5 percent from its certified value). The date of gas cylinder preparation, certified organic concentration, and recommended maximum shelf life must be affixed to each cylinder before shipment from the gas manufacturer to the buyer. The following calibration gases are required:

3.4.1 Oxidation Catalyst Efficiency Check Calibration Gas.

Gas mixture standard with nominal concentration of 1 percent methane in air.

3.4.2 FID Linearity and NMO Calibration Gases. Three gas mixture standards with nominal propane concentrations of 20 ppm, 200 ppm, and 3000 ppm, in air.

3.4.3 CO₂ Calibration Gases. Three gas mixture standards with nominal CO₂ concentrations of 50 ppm, 500 ppm, and 1 percent, in air.

Note.-Total NMO of less than 1 ppm required for 1 percent mixture.

3.4.4 NMO Analyzer System Check Calibration Gases. Four calibration gases are needed as follows:

3.4.4.1 Propane Mixture. Gas mixture standard containing (nominal) 50 ppm CO, 50 ppm CH₄, 2 percent CO₂, and 20 ppm C₃H₈, prepared in air.

3.4.4.2 Hexane. Gas mixture standard containing (nominal) 50 ppm hexane in air.

3.4.4.3 Toluene. Gas mixture standard containing (nominal) 20 ppm toluene in air.

3.4.4.4 Methanol. Gas mixture standard containing (nominal) 100 ppm methanol in air.

4. Procedure

4.1 Sampling.

4.1.1 Cleaning Sampling Equipment. Before its initial use and after each subsequent use, a condensate trap should be thoroughly cleaned and checked to ensure that it is not contaminated. Both cleaning and checking can be accomplished by installing the trap in the condensate recovery system and treating it as if it were a sample. The trap should be heated as described in the final paragraph of Section 4.3.3. A trap may be considered clean when the CO₂ concentration in its effluent gas drops below 10 ppm. This check is optional for traps that have been used to collect samples which were then recovered according to the procedure in Section 4.3.3.

4.1.2 Sample Tank Evacuation and Leak Check. Evacuate the sample tank to 10 mm Hg absolute pressure or less. Then close the sample tank valve, and allow the tank to sit for 60 minutes.

The tank is acceptable if no change in tank vacuum is noted.

The evacuation and leak check may be conducted either in the laboratory or the field. The results of the leak check should be included in the test report.

4.1.3 Sample Train Assembly. Just before assembly, measure the tank vacuum using a mercury U-tube manometer or absolute pressure gauge. Record this vacuum, the ambient temperature, and the barometric pressure at this time. Close the sample tank valve and assemble the sampling system as shown in Figure 25-1. Immerse the condensate trap body in dry ice. The point where the inlet tube joins

the trap body should be 2.5 to 5 cm above the top of the dry ice.

4.1.4 Pretest Leak Check. A pretest leak check is required.

Calculate or measure the approximate volume of the sampling train from the probe tip to the sample tank valve. After assembling the sampling train, plug the probe tip, and make certain that the sample tank valve is closed. Turn on the vacuum pump, and evacuate the sampling system from the probe tip to the sample tank valve to an absolute pressure of 10 ppm Hg or less. Close the purge valve, turn off the pump, wait a minimum period of 5 minutes, and recheck the indicated vacuum. Calculate the maximum allowable pressure change based on a leak rate of 1 percent of the sampling rate using Equation 25-1, Section 6.2. If the measured pressure change exceeds the calculated limit, correct the problem before beginning sampling. The results of the leak check should be included in the test report.

4.1.5 Sample Train Operation. Unplug the probe tip, and place the probe into the stack such that the probe is perpendicular to the duct or stack axis; locate the probe tip at a single preselected point of average velocity facing away from the direction of gas flow. For stacks having a negative static pressure, seal the sample port sufficiently to prevent air in-leakage around the probe. Set the probe temperature controller to 129 °C (265 °F) and the filter temperature controller to 121 °C (250 °F).

Allow the probe and filter to heat for about 30 minutes before purging the sample train.

Close the sample valve, open the purge valve, and start the vacuum pump. Set the flow rate between 60 and 100 cc/min, and purge the train with stack gas for at least 10 minutes. When the temperatures at the exit ends of the probe and filter are within their specified range, sampling may begin.

Check the dry ice level around the condensate trap, and add dry ice if necessary. Record the clock time. To begin sampling, close the purge valve and stop the pump. Open the sample valve and the sample tank valve. Using the flow control valve, set the flow through the sample train to the proper rate. Adjust the flow rate as necessary to maintain a constant rate (± 10 percent) throughout the duration of the sampling period. Record the sample tank vacuum and flowmeter setting at 5-minute intervals.

(See Figure 25-8.) Select a total sample time greater than or equal to the minimum sampling time specified in the applicable subpart of the regulation; end the sampling when this time period is reached or when a constant flow rate can no longer be maintained because of reduced sample tank vacuum.

Note: If sampling had to be stopped before obtaining the minimum sampling time (specified in the applicable subpart) because a constant flow rate could not be maintained, proceed as follows: After closing the sample tank valve, remove the used sample tank from the sampling train (without disconnecting other portions of the sampling train). Take another evacuated and leak-checked sample tank, measure and record the tank vacuum, and attach the new tank to the sampling train. After the new tank is attached to the sample train, proceed with the sampling until the required minimum sampling time has been exceeded.

4.2 Sample Recovery. After sampling is completed, close the flow control valve, and record the final tank vacuum; then record the tank temperature and barometric pressure. Close the sample tank valve, and disconnect the sample tank from the sample system.

Disconnect the condensate trap at the flowmetering system, and tightly seal both ends of the condensate trap. Do not include the probe from the stack to the filter as part of the condensate sample. Keep the trap packed in dry ice until the samples are returned to the laboratory for analysis. Ensure that the test run number is properly identified on the condensate trap and the sample tank(s).

4.3 Condensate Recovery. See Figure 25-9. Set the carrier gas flow rate, and heat the catalyst to its operating temperature to condition the apparatus.

4.3.1 Daily Performance Checks. Each day before analyzing any samples, perform the following tests:

4.3.1.1 Leak Check. With the carrier gas inlets and the flow control valve closed, install a clean condensate trap in the system, and evacuate the system to 10 mm Hg absolute pressure or less. Close the vacuum pump valve and turn off the vacuum pump. Monitor the system pressure for 10 minutes. The system is acceptable if the pressure change is less than 2 mm Hg.

4.3.1.2 System Background Test. Adjust the carrier gas and auxiliary oxygen flow rate to their normal values of 100 cc/min and 150 cc/min, respectively, with the sample recovery valve in vent position. Using a 10-ml syringe withdraw a sample from the system effluent through the syringe port. Inject this sample into the NMO analyzer, and measure the CO₂ content. The system background is

acceptable if the CO₂ concentration is less than 10 ppm.

4.3.1.3 Oxidation Catalyst Efficiency Check. Conduct a catalyst efficiency test as specified in Section 5.1.2 of this method.

If the criterion of this test cannot be met, make the necessary repairs to the system before proceeding.

4.3.2 Condensate Trap CO₂ Purge and Sample Tank Pressurization.

After sampling is completed, the condensate trap will contain condensed water and organics and a small volume of sampled gas.

This gas from the stack may contain a significant amount of CO₂ which must be removed from the condensate trap before the sample is recovered. This is accomplished by purging the condensate trap with zero air and collecting the purged gas in the original sample tank.

Begin with the sample tank and condensate trap from the test run to be analyzed. Set the four-port valve of the condensate recovery system in the CO₂ purge position as shown in Figure 25-9. With the sample tank valve closed, attach the sample tank to the sample recovery system. With the sample recovery valve in the vent position and the flow control valve fully open, evacuate the manometer or pressure gauge to the vacuum of the sample tank. Next, close the vacuum pump valve, open the sample tank valve, and record the tank pressure.

Attach the dry-ice-cooled condensate trap to the recovery system, and initiate the purge by switching the sample recovery valve from vent to collect position. Adjust the flow control valve to maintain atmospheric pressure in the recovery system.

Continue the purge until the CO₂ concentration of the trap effluent is less than 5 ppm. CO₂ concentration in the trap effluent should be measured by extracting syringe samples from the recovery system and analyzing the samples with the NMO analyzer. This procedure should be used only after the NDIR response has reached a minimum level. Using a 10-ml syringe, extract a sample from the syringe port prior to the NDIR, and inject this sample into the NMO analyzer.

After the completion of the CO₂ purge, use the carrier gas bypass valve to pressurize the sample tank to approximately 1060 mm Hg absolute pressure with zero air.

4.3.3 Recovery of the Condensate Trap Sample. See Figure 25-10. Attach the

ICV to the sample recovery system. With the sample recovery valve in a closed position, between vent and collect, and the flow control and ICV valves fully open, evacuate the manometer or gauge, the connecting tubing, and the ICV to 10 mm Hg absolute pressure. Close the flow-control and vacuum pump valves.

Begin auxiliary oxygen flow to the oxidation catalyst at a rate of 150 cc/min, then switch the four-way valve to the trap recovery position and the sample recovery valve to collect position.

The system should now be set up to operate as indicated in Figure 25-10. After the manometer or pressure gauge begins to register a slight positive pressure, open the flow control valve. Adjust the flow-control valve to maintain atmospheric pressure in the system within 10 percent.

Now, remove the condensate trap from the dry ice, and allow it to warm to ambient temperature while monitoring the NDIR response. If after 5 minutes, the CO₂ concentration of the catalyst effluent is below 10,000 ppm, discontinue the auxiliary oxygen flow to the oxidation catalyst. Begin heating the trap by placing it in a furnace preheated to 200 °C. Once heating has begun, carefully monitor the NDIR response to ensure that the catalyst effluent concentration does not exceed 50,000 ppm. Whenever the CO₂ concentration exceeds 50,000 ppm, supply auxiliary oxygen to the catalyst at the rate of 150 cc/min. Begin heating the tubing that connected the heated sample box to the condensate trap only after the CO₂ concentration falls below 10,000 ppm.

This tubing may be heated in the same oven as the condensate trap or with an auxiliary heat source such as a heat gun. Heating temperature must not exceed 200 °C. If a heat gun is used, heat the tubing slowly along its entire length from the upstream end to the downstream end, and repeat the pattern for a total of three times. Continue the recovery until the CO₂ concentration drops to less than 10 ppm as determined by syringe injection as described under the condensate trap CO₂ purge Procedure, Section 4.3.2.

After the sample recovery is completed, use the carrier gas bypass valve to pressurize the ICV to approximately 1060 mm Hg absolute pressure with zero air.

4.4 Analysis. Before putting the NMO analyzer into routine operation, conduct an initial performance test. Start the analyzer, and perform all the necessary functions in order to put the analyzer into proper working order; then conduct the performance test according to the procedures established in Section 5.2.

Once the performance test has been successfully completed and the CO₂ and NMO calibration response factors have been determined, proceed with sample analysis as follows:

4.4.1 Daily Operations and Calibration Checks. Before and immediately after the analysis of each set of samples or on a daily basis (whichever occurs first), conduct a calibration test according to the procedures established in Section 5.3.

If the criteria of the daily calibration test cannot be met, repeat the NMO analyzer performance test (Section 5.2) before proceeding.

4.4.2 Operating Conditions. The carrier gas flow rate is 29.5 cc/min He and 2.2 cc/min O₂. The column oven is heated to 85 °C. The order of elution for the sample from the column is CO, CH₄, CO₂, and NMO.

4.4.3 Analysis of Recovered Condensate Sample. Purge the sample loop with sample, and then inject the sample. Under the specified operating conditions, the CO₂ in the sample will elute in approximately 100 seconds. As soon as the detector response returns to baseline following the CO₂ peak, switch the carrier gas flow to backflush, and raise the column oven temperature to 195 °C as rapidly as possible. A rate of 30 °C/min has been shown to be adequate. Record the value obtained for the condensable organic material (Ccm) measured as CO₂ and any measured NMO.

Return the column oven temperature to 85 °C in preparation for the next analysis. Analyze each sample in triplicate, and report the average Ccm.

4.4.4 Analysis of Sample Tank. Perform the analysis as described in Section 4.4.3, but record only the value measured for NMO (Ctm).

4.5 Audit Samples. Analyze a set of two audit samples concurrently with any compliance samples and in exactly the same manner to evaluate the analyst's technique and the instrument calibration.

The same analysts, analytical reagents, and analytical system shall be used for the compliance samples and the EPA audit samples; if this condition is met, auditing of subsequent compliance analyses for the same enforcement agency within 30 days is not required. An audit sample set may not be used to validate different sets of compliance samples under the jurisdiction of different enforcement agencies, unless prior arrangements are made with both enforcement agencies.

Calculate the concentrations of the audit samples in ppm using the specified

sample volume in the audit instructions. (Note.-Indication of acceptable results may be obtained immediately by reporting the audit results in ppm and compliance results in ppm by telephone to the responsible enforcement agency.) Include the results of both audit samples, their identification numbers, and the analyst's name with the results of the compliance determination samples in appropriate reports to the EPA regional office or the appropriate enforcement agency during the 30-day period.

The concentration of the audit samples obtained by the analyst shall agree within 20 percent of the actual concentrations.

Failure to meet the 20-percent specification may require retests until the audit problems are resolved. However, if the audit results do not affect the compliance or noncompliance status of the affected facility, the Administrator may waive the reanalysis requirement, further audits, or retests and accept the results of the compliance test. While steps are being taken to resolve audit analysis problems, the Administrator may also choose to use the data to determine the compliance or noncompliance of the affected facility.

5. Calibration and Operational Checks

Maintain a record of performance of each item.

5.1 Initial Performance Check of Condensate Recovery Apparatus.

Perform these tests before the system is first placed in operation, after any shutdown of 6 months or more, and after any major modification of the system, or at the specified frequency.

5.1.1 Carrier Gas and Auxiliary O₂ Blank Check. Analyze each new tank of carrier gas or auxiliary O₂ with the NMO analyzer to check for contamination. Treat the gas cylinders as noncondensable gas samples, and analyze according to the procedure in Section 4.4.3. Add together any measured CH₄, CO, CO₂, or NMO. The total concentration must be less than 5 ppm.

5.1.2 Catalyst Efficiency Check. With a clean condensate trap installed in the recovery system, replace the carrier gas cylinder with the high level methane standard gas cylinder (Section 3.4.1). Set the four-port valve to the recovery position, and attach an ICV to the recovery system. With the sample recovery valve in vent position and the flow-control and ICV valves fully open, evacuate the manometer or gauge, the connecting tubing, and the ICV to 10 mm Hg absolute pressure. Close the flow-control and vacuum pump valves.

After the NDIR response has stabilized, switch the sample recovery valve from vent to collect. When the manometer or pressure gauge begins to register a slight positive pressure, open the flow-control valve. Keep the flow adjusted so that atmospheric pressure is maintained in the system within 10 percent. Continue collecting the sample in a normal manner until the ICV is filled to a nominal gauge pressure of 300 mm Hg. Close the ICV valve, and remove the ICV from the system. Place the sample recovery valve in the vent position, and return the recovery system to its normal carrier gas and normal operating conditions. Analyze the ICV for CO₂ using the NMO analyzer; the catalyst efficiency is acceptable if the CO₂ concentration is within 2 percent of the methane standard concentration.

5.1.3 System Performance Check. Construct a liquid sample injection unit similar in design to the unit shown in Figure 25-7. Insert this unit into the condensate recovery and conditioning system in place of a condensate trap, and set the carrier gas and auxiliary O₂ flow rates to normal operating levels. Attach an evacuated ICV to the system, and switch from system vent to collect. With the carrier gas routed through the injection unit and the oxidation catalyst, inject a liquid sample (See Sections 5.1.3.1 to 5.1.3.4) into the injection port. Operate the trap recovery system as described in Section 4.3.3. Measure the final ICV pressure, and then analyze the vessel to determine the CO₂ concentration. For each injection, calculate the percent recovery using the equation in Section 6.6.

The performance test is acceptable if the average percent recovery is 100 ± 10 percent with a relative standard deviation

(Section 6.9) of less than 5 percent for each set of triplicate

injections as follows:

5.1.3.1 50 μ l Hexane.

5.1.3.2 10 μ l Hexane.

5.1.3.3 50 μ l Decane.

5.1.3.4 10 μ l Decane.

5.2 Initial NMO Analyzer Performance Test. Perform these tests before the system is first placed in operation, after any shutdown longer than 6 months, and after any major modification of the system.

5.2.1 Oxidation Catalyst Efficiency Check. Turn off or bypass the NMO

analyzer reduction catalyst. Make triplicate injections of the high level methane standard (Section 3.4.1). The oxidation catalyst operation is acceptable if the FID response is less than 1 percent of the injected methane concentration.

5.2.2 Reduction Catalyst Efficiency Check. With the oxidation catalyst unheated or bypassed and the heated reduction catalyst bypassed, make triplicate injections of the high level methane standard (Section 3.4.1). Repeat this procedure with both catalysts operative. The reduction catalyst operation is acceptable if the response under both conditions agree within 5 percent.

5.2.3 Analyzer Linearity Check and NMO Calibration. While operating both the oxidation and reduction catalysts, conduct a linearity check of the analyzer using the propane standards specified in Section 3.4.2. Make triplicate injections of each calibration gas, and then calculate the average response factor (area/ppm C) for each gas, as well as the overall mean of the response factor values. The instrument linearity is acceptable if the average response factor of each calibration gas is within 2.5 percent of the overall mean value and if the relative standard deviation (Section 6.9) for each set of triplicate injections is less than 2 percent. Record the overall mean of the propane response factor values as the NMO calibration response factor (RFNMO).

Repeat the linearity check using the CO₂ standards specified in Section 3.4.3. Make triplicate injections of each gas, and then calculate the average response factor (area/ppm C) for each gas, as well as the overall mean of the response factor values. Record the overall mean of the response factor values as the CO₂ calibration response factor (RFCO₂). Linearity is acceptable if the average response factor of each calibration gas is within 2.5 percent of the overall mean value and if the relative standard deviation for each set of triplicate injections is less than 2 percent. The RFCO₂ must be within 10 percent of the RFNMO.

5.2.4 System Performance Check. Check the column separation and overall performance of the analyzer by making triplicate injections of the calibration gases listed in Section 3.4.4.

The analyzer performance is acceptable if the measured NMO value for each gas (average of triplicate injections) is within 5 percent of the expected value.

5.3 NMO Analyzer Daily Calibration.

5.3.1 CO₂ Response Factor. Inject triplicate samples of the high level CO₂

calibration gas (Section 3.4.3), and calculate the average response factor. The system operation is adequate if the calculated response factor is within 5 percent of the RFCO₂ calculated during the initial performance test (Section 5.2.3). Use the daily response factor (DRFCO₂) for analyzer calibration and the calculation of measured CO₂ concentrations in the ICV samples.

5.3.2 NMO Response Factors. Inject triplicate samples of the mixed propane calibration cylinder (Section 3.4.4.1), and calculate the average NMO response factor. The system operation is adequate if the calculated response factor is within 5 percent of the RFNMO calculated during the initial performance test

(Section 5.2.4). Use the daily response factor (DRFNMO) for

analyzer calibration and calculation of NMO concentrations in the sample tanks.

5.4 Sample Tank and ICV Volume. The volume of the gas sampling tanks used must be determined. Determine the tank and ICV volumes by weighing them empty and then filled with deionized distilled water; weigh to the nearest 5 g, and record the results. Alternatively, measure the volume of water used to fill them to the nearest 5 ml.

6. Calculations

All equations are written using absolute pressure; absolute pressures are determined by adding the measured barometric pressure to the measured gauge or manometer pressure.

6.1 Nomenclature.

C=TGNMO concentration of the effluent, ppm C equivalent.

C_c=Calculated condensible organic (condensate trap) concentration of the effluent, ppm C equivalent.

C_{cm}=Measured concentration (NMO analyzer) for the condensate trap ICV, ppm CO₂.

C_t=Calculated noncondensable organic concentration (sample tank) of the effluent, ppm C equivalent.

C_{tm}=Measured concentration (NMO analyzer) for the sample tank, ppm NMO.

F=Sampling flow rate, cc/min.

L=Volume of liquid injected, μ l.

M=Molecular weight of the liquid injected, g/g-mole.

mC =TGNMO mass concentration of the effluent, mg C/dsm³ .

N=Carbon number of the liquid compound injected (N=12 for decane, N=6 for hexane).

Pf =Final pressure of the intermediate collection vessel, mm Hg absolute.

Pb =Barometric pressure, cm Hg.

Pti =Gas sample tank pressure before sampling, mm Hg absolute.

Pt =Gas sample tank pressure after sampling, but before pressurizing, mm Hg absolute.

Ptf =Final gas sample tank pressure after pressurizing, mm Hg absolute.

Tf =Final temperature of intermediate collection vessel, °K.

Tti =Sample tank temperature before sampling, °K.

Tt =Sample tank temperature at completion of sampling, °K.

Ttf =Sample tank temperature after pressurizing, °K.

V=Sample tank volume, m³.

Vt =Sample train volume, cc.

Vv =Intermediate collection vessel volume, m³.

Vs =Gas volume sampled, dsm³.

n=Number of data points.

q=Total number of analyzer injections of intermediate collection vessel during analysis (where k=injection number, 1 . . . q).

r=Total number of analyzer injections of sample tank during analysis (where j=injection number, 1 . . . r).

xi =Individual measurements.

ELR Code of Federal Regulations

\bar{x} =Mean value.

ρ =Density of liquid injected, g/cc.

Θ =Leak check period, min.

ΔP =Allowable pressure change, cm Hg.

6.2 Allowable Pressure Change. For the pretest leak check, calculate the allowable pressure change:

$$\Delta P = 0.01 \frac{FPb \Theta}{V_t} \quad \text{Eq. 25-1}$$

6.3 Sample Volume. For each test run, calculate the gas volume sampled:

$$V_s = 0.3857 V \frac{(P_t - P_{ti})}{(T_t - T_{ti})} \quad \text{Eq. 25-2}$$

6.4 Noncondensable Organics. For each sample tank, determine the concentration of nonmethane organics (ppm C):

$$C_t = \frac{(P_t - P_{ti})}{(T_t - T_{ti})} \sum_{j=1}^r C_{tmj} \quad \text{Eq. 25-3}$$

6.5 Condensable Organics. For each condensate trap determine the concentration of organics (ppm C):

$$C_c = 0.3857 \frac{V_v P_f}{V_s T_f} \sum_{k=1}^q C_{cmk} \quad \text{Eq. 25-4}$$

6.6 TGNMO. To determine the TGNMO concentration for each test run, use the following equation:

$$C = C_t + C_c$$

Eq. 25-5

6.7 TGNMO Mass Concentration. To determine the TGNMO mass concentration as carbon for each test run, use the following equation:

$$m_c = 0.4993 C$$

Eq. 25-6

6.8 Percent Recovery. To calculate the percent recovery for the liquid injections to the condensate recovery and conditioning system use the following equation.

$$\text{Percent recovery} = 1.604 \frac{M}{L} \frac{V_v}{P} \frac{P_t}{T_f} \frac{C_{cm}}{N}$$

Eq. 25-7

6.9 Relative Standard Deviation.

$$RSD = \frac{100}{x} \sqrt{\frac{\sum (x_i - \bar{x})^2}{n - 1}}$$

Eq. 25-8

7. Bibliography

1. Salo, Albert E., Samuel Witz, and Robert D. MacPhee. Determination of Solvent Vapor Concentrations by Total Combustion Analysis: A Comparison of Infrared with Flame Ionization Detectors. Paper No. 75-33.2. (Presented at the 68th Annual Meeting of the Air Pollution Control Association. Boston, Massachusetts. June 15-20, 1975.) 14 p.

2. Salo, Albert E., William L. Oaks, and Robert D. MacPhee.

Measuring the Organic Carbon Content of Source Emissions for Air Pollution Control. Paper No. 74-190. (Presented at the 67th Annual Meeting of the Air Pollution Control Association. Denver, Colorado. June 9-13, 1974.) 25 p.

Illustration appears only in printed copy. Part 60, pages 1053-62.

40 CFR PROTECTION OF ENVIRONMENT

CHAPTER I ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C AIR PROGRAMS

PART 60 STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

APPENDIXES TO PART 60

METHOD 5-DETERMINATION OF PARTICULATE EMISSIONS FROM STATIONARY SOURCES

METHOD 5-DETERMINATION OF PARTICULATE EMISSIONS FROM STATIONARY SOURCES

1. Principle and Applicability

1.1 Principle. Particulate matter is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature in the range of $120 \pm 14^\circ \text{C}$ ($248 \pm 25^\circ \text{F}$) or such other temperature as specified by an applicable subpart of the standards or approved by Administrator, U.S. Environmental Protection Agency, for a particular application. The particulate mass, which includes any material that condenses at or above the filtration temperature, is determined gravimetrically after removal of uncombined water.

1.2 Applicability. This method is applicable for the determination of particulate emissions from stationary sources.

2. Apparatus

2.1 Sampling Train. A schematic of the sampling train used in this method is shown in Figure 5-1. Complete construction details are given in APTD-0581 (Citation 2 in Bibliography); commercial models of this train are also available. For changes from APTD-0581 and for allowable modifications of the train shown in Figure 5-1, see the following subsections.

The operating and maintenance procedures for the sampling train are described in APTD-0576 (Citation 3 in Bibliography).

Since correct usage is important in obtaining valid results, all users should read APTD-0576 and adopt the operating and maintenance procedures outlined in it, unless otherwise specified herein. The sampling train consists of the following components:

Illustration appears only in printed copy. Part 60, page 554.



2.1.1 Probe Nozzle. Stainless steel (316) or glass with sharp, tapered leading edge. The angle of taper shall be $\leq 30^\circ$ and the taper shall be on the outside to preserve a constant internal diameter. The probe nozzle shall be of the button-hook or elbow design, unless otherwise specified by the Administrator. If made of stainless steel, the nozzle shall be constructed from seamless tubing; other materials of construction may be used, subject to the approval of the Administrator.

A range of nozzle sizes suitable for isokinetic sampling should be available, e.g., 0.32 to 1.27 cm ($1/8$ to $1/2$ in.)-or larger if higher volume sampling trains are used-inside diameter (ID) nozzles in increments of 0.16 cm ($1/16$ in.). Each nozzle shall be calibrated according to the procedures outlined in Section 5.

2.1.2 Probe Liner. Borosilicate or quartz glass tubing with a heating system capable of maintaining a gas temperature at the exit end during sampling of $120 \pm 14^\circ \text{C}$ ($248 \pm 25^\circ \text{F}$), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. (The tester may opt to operate the equipment at a temperature lower than that specified.) Since the actual temperature at the outlet of the probe is not usually monitored during sampling, probes constructed according to APTD-0581 and utilizing the calibration curves of APTD-0576 (or calibrated according to the procedure outlined in APTD-0576) will be considered acceptable.

Either borosilicate or quartz glass probe liners may be used for stack temperatures up to about 480°C (900°F); quartz liners shall be used for temperatures between 480 and 900°C (900 and $1,650^\circ \text{F}$). Both types of liners may be used at higher temperatures than specified for short periods of time, subject to the approval of the Administrator. The softening temperature for borosilicate is 820°C ($1,508^\circ \text{F}$), and for quartz it is $1,500^\circ \text{C}$ ($2,732^\circ \text{F}$).

Whenever practical, every effort should be made to use borosilicate or quartz glass probe liners. Alternatively, metal liners (e.g., 316 stainless steel, Incoloy 825, {2} or other corrosion resistant metals) made of seamless tubing may be used, subject to the approval of the Administrator.

{2} Mention of trade names or specific product does
not constitute endorsement by the Environmental Protection
Agency.



2.1.3 Pitot Tube. Type S, as described in Section 2.1 of Method 2, or other device approved by the Administrator. The pitot tube shall be attached to the probe (as shown in Figure 5-1) to allow constant monitoring of the stack gas velocity.

The impact (high pressure) opening plane of the pitot tube shall be even with or above the nozzle entry plane (see Method 2, Figure 2-6b) during sampling. The Type S pitot tube assembly shall have a known coefficient, determined as outlined in Section 4 of Method 2.

2.1.4 Differential Pressure Gauge. Inclined manometer or equivalent device (two), as described in Section 2.2 of Method 2. One manometer shall be used for velocity head (ρRHO) readings, and the other, for orifice differential pressure readings.

2.1.5 Filter Holder. Borosilicate glass, with a glass frit filter support and a silicone rubber gasket. Other materials of construction (e.g., stainless steel, Teflon, Viton) may be used, subject to approval of the Administrator. The holder design shall provide a positive seal against leakage from the outside or around the filter. The holder shall be attached immediately at the outlet of the probe (or cyclone, if used).

2.1.6 Filter Heating System. Any heating system capable of maintaining a temperature around the filter holder during sampling of $120 \pm 14^\circ \text{C}$ ($248 \pm 25^\circ \text{F}$), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. Alternatively, the tester may opt to operate the equipment at a temperature lower than that specified. A temperature gauge capable of measuring temperature to within 3°C (5.4°F) shall be installed so that the temperature around the filter holder can be regulated and monitored during sampling. Heating systems other than the one shown in APTD-0581 may be used.

2.1.7 Condenser. The following system shall be used to determine the stack gas moisture content: Four impingers connected in series with leak-free ground glass fittings or any similar leak-free non-contaminating fittings. The first, third, and fourth impingers shall be of the Greenburg-Smith design, modified by replacing the tip with 1.3 cm (1/2 in.) ID glass tube extending to about 1.3 cm (1/2 in.) from the bottom of the flask. The second impinger shall be of the Greenburg-Smith design with the standard tip. Modifications (e.g., using flexible connections between the impingers, using materials other than glass, or using flexible vacuum lines to connect the filter holder to the condenser) may be



used, subject to the approval of the Administrator.

The first and second impingers shall contain known quantities of water (Section 4.1.3), the third shall be empty, and the fourth shall contain a known weight of silica gel, or equivalent desiccant. A thermometer, capable of measuring temperature to within 1°C (2°F) shall be placed at the outlet of the fourth impinger for monitoring purposes.

Alternatively, any system that cools the sample gas stream and allows measurement of the water condensed and moisture leaving the condenser, each to within 1 ml or 1 g may be used, subject to the approval of the Administrator. Acceptable means are to measure the condensed water either gravimetrically or volumetrically and to measure the moisture leaving the condenser by: (1) monitoring the temperature and pressure at the exit of the condenser and using Dalton's law of partial pressures; or (2) passing the sample gas stream through a tared silica gel (or equivalent desiccant) trap with exit gases kept below 20°C (68°F) and determining the weight gain.

If means other than silica gel are used to determine the amount of moisture leaving the condenser, it is recommended that silica gel (or equivalent) still be used between the condenser system and pump to prevent moisture condensation in the pump and metering devices and to avoid the need to make corrections for moisture in the metered volume.

Note: If a determination of the particulate matter collected in the impingers is desired in addition to moisture content, the impinger system described above shall be used, without modification.

Individual States or control agencies requiring this information shall be contacted as to the sample recovery and analysis of the impinger contents.

2.1.8 Metering System. Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 3°C (5.4°F), dry gas meter capable of measuring volume to within 2 percent, and related equipment, as shown in Figure 5-1. Other metering systems capable of maintaining sampling rates within 10 percent of isokinetic and of determining sample volumes to within 2 percent may be used, subject to the approval of the Administrator. When the metering system is used in conjunction with a pitot tube, the system shall enable checks of isokinetic rates.



Sampling trains utilizing metering systems designed for higher flow rates than that described in APTD-0581 or APDT-0576 may be used provided that the specifications of this method are met.

2.1.9 Barometer. Mercury aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in.

Hg). In many cases the barometric reading may be obtained from a nearby National Weather Service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase or vice versa for elevation decrease.

2.1.10 Gas Density Determination Equipment. Temperature sensor and pressure gauge, as described in Sections 2.3 and 2.4 of Method 2, and gas analyzer, if necessary, as described in Method 3. The temperature sensor shall, preferably, be permanently attached to the pitot tube or sampling probe in a fixed configuration, such that the tip of the sensor extends beyond the leading edge of the probe sheath and does not touch any metal. Alternatively, the sensor may be attached just prior to use in the field. Note, however, that if the temperature sensor is attached in the field, the sensor must be placed in an interference-free arrangement with respect to the Type S pitot tube openings (see Method 2, Figure 2-7). As a second alternative, if a difference of not more than 1 percent in the average velocity measurement is to be introduced, the temperature gauge need not be attached to the probe or pitot tube. (This alternative is subject to the approval of the Administrator.)

2.2 Sample Recovery. The following items are needed.

2.2.1 Probe-Liner and Probe-Nozzle Brushes. Nylon bristle brushes with stainless steel wire handles. The probe brush shall have extensions (at least as long as the probe) of stainless steel, Nylon, Teflon, or similarly inert material. The brushes shall be properly sized and shaped to brush out the probe liner and nozzle.

2.2.2 Wash Bottles-Two. Glass wash bottles are recommended; polyethylene wash bottles may be used at the option



of the tester.

It is recommended that acetone not be stored in polyethylene bottles for longer than a month.

2.2.3 Glass Sample Storage Containers. Chemically resistant, borosilicate glass bottles, for acetone washes, 500 ml or 1000 ml. Screw cap liners shall either be rubber-backed Teflon or shall be constructed so as to be leak-free and resistant to chemical attack by acetone. (Narrow mouth glass bottles have been found to be less prone to leakage.) Alternatively, polyethylene bottles may be used.

2.2.4 Petri Dishes. For filter samples, glass or polyethylene, unless otherwise specified by the Administrator.

2.2.5 Graduated Cylinder and/or Balance. To measure condensed water to within 1 ml or 1 g. Graduated cylinders shall have subdivisions no greater than 2 ml. Most laboratory balances are capable of weighing to the nearest 0.5 g or less. Any of these balances is suitable or use here and in Section 2.3.4.

2.2.6 Plastic Storage Containers. Air-tight containers to store silica gel.

2.2.7 Funnel and Rubber Policeman. To aid in transfer of silica gel to container; not necessary if silica gel is weighed in the field.

2.2.8 Funnel. Glass or polyethylene, to aid in sample recovery.

2.3 Analysis. For analysis, the following equipment is needed.

2.3.1 Glass Weighing Dishes.

2.3.2 Desiccator.

2.3.3 Analytical Balance. To measure to within 0.1 mg.

2.3.4 Balance. To measure to within 0.5 g.



2.3.5 Beakers. 250 ml.

2.3.6 Hygrometer. To measure the relative humidity of the laboratory environment.

2.3.7 Temperature Gauge. To measure the temperature of the laboratory environment.

3. Reagents

3.1 Sampling. The reagents used in sampling are as follows: 3.1.1 Filters. Glass fiber filters, without organic binder, exhibiting at least 99.95 percent efficiency (<0.05 percent penetration) on 0.3-micron dioctyl phthalate smoke particles.

The filter efficiency test shall be conducted in accordance with ASTM Standard Method D2986 - 71 (Reapproved 1978) (incorporated by reference-see § 60.17). Test data from the supplier's quality control program are sufficient for this purpose. In sources containing SO_2 or SO_3 , the filter material must be of a type that is unreactive to SO_2 or SO_3 . Citation 10 in Bibliography, may be used to select the appropriate filter.

3.1.2 Silica Gel. Indicating type, 6 to 16 mesh. If previously used, dry at $175^\circ C$ ($350^\circ F$) for 2 hours. New silica gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used, subject to the approval of the Administrator.

3.1.3 Water. When analysis of the material caught in the impingers is required, deionized distilled water shall be used. Run blanks prior to field use to eliminate a high blank on test samples.

3.1.4 Crushed Ice.

3.1.5 Stopcock Grease. Acetone-insoluble, heat-stable silicone grease. This is not necessary if screw-on connectors with Teflon sleeves, or similar, are used. Alternatively, other types of stopcock grease may be used, subject to the approval of the Administrator.

3.2 Sample Recovery. Acetone-reagent grade, ≤ 0.001 percent residue, in glass bottles-is required. Acetone from metal



containers generally has a high residue blank and should not be used. Sometimes, suppliers transfer acetone to glass bottles from metal containers; thus, acetone blanks shall be run prior to field use and only acetone with low blank values (≤ 0.001 percent) shall be used.

In no case shall a blank value of greater than 0.001 percent of the weight of acetone used be subtracted from the sample weight.

3.3 Analysis. Two reagents are required for the analysis: 3.3.1 Acetone. Same as 3.2.

3.3.2 Desiccant. Anhydrous calcium sulfate, indicating type.

Alternatively, other types of desiccants may be used, subject to the approval of the Administrator.

4. Procedure

4.1 Sampling. The complexity of this method is such that, in order to obtain reliable results, testers should be trained and experienced with the test procedures.

4.1.1 Pretest Preparation. It is suggested that sampling equipment be maintained according to the procedure described in APTD-0576.

Weigh several 200 to 300 g portions of silica gel in air-tight containers to the nearest 0.5 g. Record the total weight of the silica gel plus container, on each container. As an alternative, the silica gel need not be preweighed, but may be weighed directly in the impinger or sampling holder just prior to train assembly.

Check filters visually against light for irregularities and flaws or pinhole leaks. Label filters of the proper diameter on the back side near the edge using numbering machine ink.

As an alternative, label the shipping containers (glass or plastic petri dishes) and keep the filters in these containers at all times except during sampling and weighing.



Desiccate the filters at $20 \pm 5.6^\circ \text{C}$ ($68 \pm 10^\circ \text{F}$) and ambient pressure for at least 24 hours and weigh at intervals of at least 6 hours to a constant weight, i.e., 0.5 mg change from previous weighing; record results to the nearest 0.1 mg. During each weighing the filter must not be exposed to the laboratory atmosphere for a period greater than 2 minutes and a relative humidity above 50 percent. Alternatively (unless otherwise specified by the Administrator), the filters may be oven dried at 105°C (220°F) for 2 to 3 hours, desiccated for 2 hours, and weighed.

Procedures other than those described, which account for relative humidity effects, may be used, subject to the approval of the Administrator.

4.1.2 Preliminary Determinations. Select the sampling site and the minimum number of sampling points according to Method 1 or as specified by the Administrator. Determine the stack pressure, temperature, and the range of velocity heads using Method 2; it is recommended that a leak-check of the pitot lines (see Method 2, Section 3.1) be performed. Determine the moisture content using Approximation Method 4 or its alternatives for the purpose of making isokinetic sampling rate settings. Determine the stack gas dry molecular weight, as described in Method 2, Section 3.6; if integrated Method 3 sampling is used for molecular weight determination, the integrated bag sample shall be taken simultaneously with, and for the same total length of time as, the particulate sample run.

Select a nozzle size based on the range of velocity heads, such that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates. During the run, do not change the nozzle size. Ensure that the proper differential pressure gauge is chosen for the range of velocity heads encountered (see Section 2.2 of Method 2).

Select a suitable probe liner and probe length such that all traverse points can be sampled. For large stacks, consider sampling from opposite sides of the stack to reduce the length of probes.

Select a total sampling time greater than or equal to the minimum total sampling time specified in the test procedures for the specific industry such that (1) the sampling time per point is not less than 2 min (or some greater time interval as specified by the Administrator), and (2) the sample volume taken (corrected to standard conditions) will exceed the

required minimum total gas sample volume. The latter is based on an approximate average sampling rate.

It is recommended that the number of minutes sampled at each point be an integer or an integer plus one-half minute, in order to avoid timekeeping errors. The sampling time at each point shall be the same.

In some circumstances, e.g., batch cycles, it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas sample volumes. In these cases, the Administrator's approval must first be obtained.

4.1.3 Preparation of Collection Train. During preparation and assembly of the sampling train, keep all openings where contamination can occur covered until just prior to assembly or until sampling is about to begin.

Place 100 ml of water in each of the first two impingers, leave the third impinger empty, and transfer approximately 200 to 300 g of preweighed silica gel from its container to the fourth impinger. More silica gel may be used, but care should be taken to ensure that it is not entrained and carried out from the impinger during sampling. Place the container in a clean place for later use in the sample recovery. Alternatively, the weight of the silica gel plus impinger may be determined to the nearest 0.5 g and recorded.

Using a tweezer or clean disposable surgical gloves, place a labeled (identified) and weighed filter in the filter holder.

Be sure that the filter is properly centered and the gasket properly placed so as to prevent the sample gas stream from circumventing the filter. Check the filter for tears after assembly is completed.

When glass liners are used, install the selected nozzle using a Viton A O-ring when stack temperatures are less than 260°C (500°F) and an asbestos string gasket when temperatures are higher. See APTD-0576 for details. Other connecting systems using either 316 stainless steel or Teflon ferrules may be used.

When metal liners are used, install the nozzle as above or by a leak-free direct mechanical connection. Mark the probe with heat resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

Set up the train as in Figure 5-1, using (if necessary) a very light coat of silicone grease on all ground glass joints.

greasing only the outer portion (see APTD-0576) to avoid possibility of contamination by the silicone grease. Subject to the approval of the Administrator, a glass cyclone may be used between the probe and filter holder when the total particulate catch is expected to exceed 100 mg or when water droplets are present in the stack gas.

Place crushed ice around the impingers.

4.1.4 Leak-Check Procedures.

4.1.4.1 Pretest Leak-Check. A pretest leak-check is recommended, but not required. If the tester opts to conduct the pretest leak-check, the following procedure shall be used.

After the sampling train has been assembled, turn on and set the filter and probe heating systems at the desired operating temperatures. Allow time for the temperatures to stabilize.

If a Viton A O-ring or other leak-free connection is used in assembling the probe nozzle to the probe liner, leak-check the train at the sampling site by plugging the nozzle and pulling a 380 mm Hg (15 in. Hg) vacuum.

Note: A lower vacuum may be used, provided that it is not exceeded during the test.

If an asbestos string is used, do not connect the probe to the train during the leak-check. Instead, leak-check the train by first plugging the inlet to the filter holder (cyclone, if applicable) and pulling a 380 mm Hg (15 in. Hg) vacuum (see Note immediately above). Then connect the probe to the train and leak-check at about 25 mm Hg (1 in. Hg) vacuum; alternatively, the probe may be leak-checked with the rest of the sampling train, in one step, at 380 mm Hg (15 in. Hg) vacuum. Leakage rates in excess of 4 percent of the average sampling rate or 0.00057 m³/min (0.02 cfm), whichever is less, are unacceptable.

The following leak-check instructions for the sampling train described in APTD-0576 and APTD-0581 may be helpful. Start the pump with bypass valve fully open and coarse adjust valve, completely closed. Partially open the coarse adjust valve and slowly close the bypass valve until the desired vacuum is reached. Do not reverse direction of bypass valve; this will cause water to back up into the filter holder. If the desired vacuum is exceeded, either leak-check



at this higher vacuum or end the leak-check as shown below and start over.

When the leak-check is completed, first slowly remove the plug from the inlet to the probe, filter holder, or cyclone (if applicable) and immediately turn off the vacuum pump. This prevents the water in the impingers from being forced backward into the filter holder and silica gel from being entrained backward into the third impinger.

4.1.4.2 Leak-Checks During Sample Run. If, during the sampling run, a component (e.g., filter assembly or impinger) change becomes necessary, a leak-check shall be conducted immediately before the change is made. The leak-check shall be done according to the procedure outlined in Section 4.1.4.1 above, except that it shall be done at a vacuum equal to or greater than the maximum value recorded up to that point in the test. If the leakage rate is found to be no greater than 0.00057 m³/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction will need to be applied to the total volume of dry gas metered; if, however, a higher leakage rate is obtained, the tester shall either record the leakage rate and plan to correct the sample volume as shown in Section 6.3 of this method, or shall void the sampling run.

Immediately after component changes, leak-checks are optional; if such leak-checks are done, the procedure outlined in Section 4.1.4.1 above shall be used.

4.1.4.3 Post-test Leak-Check. A leak-check is mandatory at the conclusion of each sampling run. The leak-check shall be done in accordance with the procedures outlined in Section 4.1.4.1, except that it shall be conducted at a vacuum equal to or greater than the maximum value reached during the sampling run. If the leakage rate is found to be no greater than 0.00057 m³/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction need be applied to the total volume of dry gas metered. If, however, a higher leakage rate is obtained, the tester shall either record the leakage rate and correct the sample volume as shown in Section 6.3 of this method, or shall void the sampling run.

4.1.5 Particulate Train Operation. During the sampling run, maintain an isokinetic sampling rate (within 10 percent of true isokinetic unless otherwise specified by the Administrator) and a temperature around the filter of 120 ± 14° C (248 ± 25° F), or such other temperature as specified by an applicable subpart of the standards or approved by the



Administrator.

For each run, record the data required on a data sheet such as the one shown in Figure 5-2. Be sure to record the initial dry gas meter reading. Record the dry gas meter readings at the beginning and end of each sampling time increment, when changes in flow rates are made, before and after each leak-check, and when sampling is halted. Take other readings required by Figure 5-2 at least once at each sample point during each time increment and additional readings when significant changes (20 percent variation in velocity head readings) necessitate additional adjustments in flow rate. Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse.

Clean the portholes prior to the test run to minimize the chance of sampling deposited material. To begin sampling, remove the nozzle cap, verify that the filter and probe heating systems are up to temperature, and that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions.

Nomographs are available, which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations.

These nomographs are designed for use when the Type S pitot tube coefficient is 0.85 ± 0.02 , and the stack gas equivalent density (dry molecular weight) is equal to 29 ± 4 . APTD-0576 details the procedure for using the nomographs. If C_p and M_d are outside the above stated ranges do not use the nomographs unless appropriate steps (see Citation 7 in Bibliography) are taken to compensate for the deviations.

Figure 5-2-Particulate field data

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Plant		
temperature		Ambient
Location		
Barometric pressure		
Operator		
moisture, %		Assumed
Date		
length, m. (ft.)		Probe
Run No.		
identification No.		Nozzle
Sample box No.		
calibrated nozzle diameter, cm (in.)		Average
Meter box No.		

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ELR Code of Federal Regulations

heater setting		Probe
Meter Δ H ₂		
rate, m ³ /min. (cfm)		Leak
C factor .....	|	|
liner material .....	|	| Probe
Pitot tube coefficient, C _p		
pressure, mm. Hg (in. Hg)		Static
No.		Filter

Schematic of Stack Cross Section

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ELR Code of Federal Regulations

Traverse point		Gas sample temperature at dry		Stack		Temperature of		Pressure
Gas sample	|	gas meter	|	Filter holder	|	gas leaving	|	differential
number	|	Sampling time	|	temperature	|	Velocity head	|	across
orifice	|	volume	|	temperature	|	condenser or last	|	meter
						impinger		
		Inlet		Outlet				
H ₂ O		(c). min.		mm Hg (in.		(TS). °C (°F)		(° PS). mm
m ³ (ft ³)		°C (° F)		° C (° F)		° C (° F)		mm H ₂ O (in.
				Hg)		(in.) H ₂ O		

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Expertise

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Note that when two or more trains are used, separate analyses of the front-half and (if applicable) impinger catches



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from each train shall be performed, unless identical nozzle sizes were used on all trains, in which case, the front-half catches from the individual trains may be combined (as may the impinger catches) and one analysis of front-half catch and one analysis of impinger catch may be performed. Consult with the Administrator for details concerning the calculation of results when two or more trains are used.

At the end of the sample run, turn off the coarse adjust valve, remove the probe and nozzle from the stack, turn off the pump, record the final dry gas meter reading, and conduct a post-test leak-check, as outlined in Section 4.1.4.3. Also, leak-check the pitot lines as described in Method 2, Section 3.1; the lines must pass this leak-check, in order to validate the velocity head data.

4.1.6 Calculation of Percent Isokinetic. Calculate percent isokinetic (see Calculations, Section 6) to determine whether the run was valid or another test run should be made. If there was difficulty in maintaining isokinetic rates due to source conditions, consult with the Administrator for possible variance on the isokinetic rates.

4.2 Sample Recovery. Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period. Allow the probe to cool.

When the probe can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over it to prevent losing or gaining particulate matter.

Do not cap off the probe tip tightly while the sampling train is cooling down as this would create a vacuum in the filter holder, thus drawing water from the impingers into the filter holder.

Before moving the sample train to the cleanup site, remove the probe from the sample train, wipe off the silicone grease, and cap the open outlet of the probe. Be careful not to lose any condensate that might be present. Wipe off the silicone grease from the filter inlet where the probe was fastened and cap it. Remove the umbilical cord from the last impinger and cap the impinger. If a flexible line is used between the first impinger or condenser and the filter holder, disconnect the line at the filter holder and let any condensed water or liquid drain into the impingers or condenser. After wiping off the silicone grease, cap off the filter holder outlet and impinger inlet. Either ground-glass stoppers, plastic



caps, or serum caps may be used to close these openings.

Transfer the probe and filter-impinger assembly to the cleanup area. This area should be clean and protected from the wind so that the chances of contaminating or losing the sample will be minimized.

Save a portion of the acetone used for cleanup as a blank.

Take 200 ml of this acetone directly from the wash bottle being used and place it in a glass sample container labeled "acetone blank."

Inspect the train prior to and during disassembly and note any abnormal conditions. Treat the samples as follows: Container No. 1. Carefully remove the filter from the filter holder and place it in its identified petri dish container.

Use a pair of tweezers and/or clean disposable surgical gloves to handle the filter. If it is necessary to fold the filter, do so such that the particulate cake is inside the fold. Carefully transfer to the petri dish any particulate matter and/or filter fibers which adhere to the filter holder gasket, by using a dry Nylon bristle brush and/or a sharp-edged blade. Seal the container.

Container No. 2. Taking care to see that dust on the outside of the probe or other exterior surfaces does not get into the sample, quantitatively recover particulate matter or any condensate from the probe nozzle, probe fitting, probe liner, and front half of the filter holder by washing these components with acetone and placing the wash in a glass container. Distilled water may be used instead of acetone when approved by the Administrator and shall be used when specified by the Administrator; in these cases, save a water blank and follow the Administrator's directions on analysis. Perform the acetone rinses as follows:

Carefully remove the probe nozzle and clean the inside surface by rinsing with acetone from a wash bottle and brushing with a Nylon bristle brush. Brush until the acetone rinse shows no visible particles, after which make a final rinse of the



inside surface with acetone.

Brush and rinse the inside parts of the Swagelok fitting with acetone in a similar way until no visible particles remain.

Rinse the probe liner with acetone by tilting and rotating the probe while squirting acetone into its upper end so that all inside surfaces will be wetted with acetone. Let the acetone drain from the lower end into the sample container. A funnel (glass or polyethylene) may be used to aid on transferring liquid washes to the container. Follow the acetone rinse with a probe brush. Hold the probe in an inclined position, squirt acetone into the upper end as the probe brush is being pushed with a twisting action through the probe; hold a sample container underneath the lower end of the probe, and catch any acetone and particulate matter which is brushed from the probe. Run the brush through the probe three times or more until no visible particulate matter is carried out with the acetone or until none remains in the probe liner on visual inspection. With stainless steel or other metal probes, run the brush through in the above prescribed manner at least six times since metal probes have small crevices in which particulate matter can be entrapped. Rinse the brush with acetone, and quantitatively collect these washings in the sample container. After the brushing, make a final acetone rinse of the probe as described above.

It is recommended that two people clean the probe to minimize sample losses. Between sampling runs, keep brushes clean and protected from contaminations.

After ensuring that all joints have been wiped clean of silicone grease, clean the inside of the front half of the filter holder by rubbing the surfaces with a Nylon bristle brush and rinsing with acetone. Rinse each surface three times or more if needed to remove visible particulate. Make a final rinse of the brush and filter holder. Carefully rinse out the glass cyclone, also (if applicable). After all acetone washings and particulate matter have been collected in the sample container, tighten the lid on the sample container so that acetone will not leak out when it is shipped to the laboratory. Mark the height of the fluid level to determine whether or not leakage occurred during transport. Label the container to clearly identify its contents.

Container No. 3. Note the color of the indicating silica gel to determine if it has been completely spent and make a notation of its condition. Transfer the silica gel from the fourth impinger to its original container and seal. A funnel may make it easier to pour the silica gel without spilling. A rubber policeman may be used as an aid in removing the silica



gel from the impinger.

It is not necessary to remove the small amount of dust particles that may adhere to the impinger wall and are difficult to remove.

Since the gain in weight is to be used for moisture calculations, do not use any water or other liquids to transfer the silica gel. If a balance is available in the field, follow the procedure for container No. 3 in Section 4.3.

Impinger Water. Treat the impingers as follows; Make a notation of any color or film in the liquid catch. Measure the liquid which is in the first three impingers to within ± 1 ml by using a graduated cylinder or by weighing it to within ± 0.5 g by using a balance (if one is available). Record the volume or weight of liquid present. This information is required to calculate the moisture content of the effluent gas.

Discard the liquid after measuring and recording the volume or weight, unless analysis of the impinger catch is required (see Note, Section 2.1.7).

If a different type of condenser is used, measure the amount of moisture condensed either volumetrically or gravimetrically.

Whenever possible, containers should be shipped in such a way that they remain upright at all times.

4.3 Analysis. Record the data required on a sheet such as the one shown in Figure 5-3. Handle each sample container as follows:

FIGURE 5-3-ANALYTICAL DATA

Plant.....
Date.....
Run No.....
Filter No.....
Amount liquid lost during transport.....



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Acetone blank volume, ml _____
 Acetone wash volume, ml _____
 Acetone blank concentration, mg/mg (Equation 5-4) _____
 Acetone wash blank, mg (Equation 5-5) _____

Container number	Weight of particulate collected, mg		
	Final weight	Tare weight	Weight gain
1.....			
2.....			
Total.....			
Less acetone blank.....			
Weight of particulate matter.....			

	Volume of liquid water collected	
	Impinger volume, ml	Silica gel weight, g
Final.....		

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Initial.....
 Liquid collected.....
 Total volume collected..... g* ml

*Convert weight of water to volume by dividing total weight increase by density of water (1 g/ml).

$$\frac{\text{Increase, g}}{\text{(1 g/ml)}} = \text{Volume water, ml}$$

Container No. 1. Leave the contents in the shipping container

or transfer the filter and any loose particulate from the sample container to a tared glass weighing dish. Desiccate for 24 hours in a desiccator containing anhydrous calcium sulfate. Weigh to a constant weight and report the results to the nearest 0.1 mg. For purposes of this Section, 4.3, the term "constant weight" means a difference of no more than 0.5 mg or 1 percent of total weight less tare weight, whichever is greater, between two consecutive weighings, with no less than 6 hours of desiccation time between weighings.

Alternatively, the sample may be oven dried at 105° C (220° F) for 2 to 3 hours, cooled in the desiccator, and weighed to a constant weight, unless otherwise specified by the Administrator.

The tester may also opt to oven dry the sample at 105° C (220° F) for 2 to 3 hours, weigh the sample, and use this weight as a final weight.

Container No. 2 Note the level of liquid in the container and confirm on the analysis sheet whether or not leakage occurred during transport. If a noticeable amount of leakage has occurred, either void the sample or use methods.

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subject to the approval of the Administrator, to correct the final results. Measure the liquid in this container either volumetrically to ± 1 ml or gravimetrically to ± 0.5 g. Transfer the contents to a tared 250-ml beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 mg.

Container No. 3. Weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g using a balance. This step may be conducted in the field.

"Acetone Blank" Container. Measure acetone in this container either volumetrically or gravimetrically. Transfer the acetone to a tared 250-ml beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 mg.

Note: At the option of the tester, the contents of Container No. 2 as well as the acetone blank container may be evaporated at temperatures higher than ambient. If evaporation is done at an elevated temperature, the temperature must be below the boiling point of the solvent; also, to prevent "bumping," the evaporation process must be closely supervised, and the contents of the beaker must be swirled occasionally to maintain an even temperature. Use extreme care, as acetone is highly flammable and has a low flash point.

4.4 Quality Control Procedures. The following quality control procedures are suggested to check the volume metering system calibration values at the field test site prior to sample collection.

These procedures are optional for the tester.

4.4.1 Meter Orifice Check. Using the calibration data obtained during the calibration procedure described in Section 5.3, determine the $\Delta H@$ for the metering system orifice. The $\Delta H@$ is the orifice pressure differential in units of in. H₂O that correlates to 0.75 cfm of air at 528°R and 29.92 in. Hg. The $\Delta H@$ is calculated as follows:

$$\Delta H@ = 0.0319 \frac{T_m \Theta}{P_{bar} Y^2 V_{2m}}$$



Eq. 5-9

Where:

ΔH =Average pressure differential across the orifice meter, in.

H₂O.

T_m =Absolute average dry gas meter temperature, °R.

P_{bar} =Barometric pressure, in. Hg.

Θ =Total sampling time, min.

Y =Dry gas meter calibration factor, dimensionless.

V_m =Volume of gas sample as measured by dry gas meter, dcf.

$$0.0319 = (0.0567 \text{ in. Hg}^\circ\text{R}) \times (0.75 \text{ cfm})^2$$

Before beginning the field test (a set of three runs usually constitutes a field test), operate the metering system (i.e., pump, volume meter, and orifice) at the $\Delta H@$ pressure differential for 10 minutes. Record the volume collected, the dry gas meter temperature, and the barometric pressure. Calculate a dry gas meter calibration check value, Y_c , as follows:

$$Y_c = \frac{10}{V_m} \frac{0.0319 T_m}{P_{bar}}^{1/2}$$

Eq. 5-10

Where:



Y_c = Dry gas meter calibration check value, dimensionless.

10 = 10 minutes of run time.

Compare the Y_c value with the dry gas meter calibration factor Y to determine that:
 $0.97Y < Y_c < 1.03Y$

If the Y_c value is not within this range, the volume metering system should be investigated before beginning the test.

4.4.2 Calibrated Critical Orifice. A calibrated critical orifice, calibrated against a wet test meter or spirometer and designed to be inserted at the inlet of the sampling meter box may be used as a quality control check by following the procedure of Section 7.2.

5. Calibration

Maintain a laboratory log of all calibrations.

5.1 Probe Nozzle. Probe nozzles shall be calibrated before their initial use in the field. Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in.). Make three separate measurements using different diameters each time, and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.). When nozzles become nicked, dented, or corroded, they shall be reshaped, sharpened, and recalibrated before use. Each nozzle shall be permanently and uniquely identified.

5.2 Pitot Tube. The Type S pitot tube assembly shall be calibrated according to the procedure outlined in Section 4 of Method 2.

5.3 Metering System.

5.3.1 Calibration Prior to Use. Before its initial use in the field, the metering system shall be calibrated as follows: Connect the metering system inlet to the outlet of a wet test meter that is accurate to within 1 percent. Refer to Figure 5.5. The wet test meter should have a capacity of 30 liters/rev (1 ft³/rev). A spirometer of 400 liters (14 ft³) or more



capacity, or equivalent, may be used for this calibration, although a wet test meter is usually more practical. The wet test meter should be periodically calibrated with a spirometer or a liquid displacement meter to ensure the accuracy of the wet test meter.

Spirometers or wet test meters of other sizes may be used, provided that the specified accuracies of the procedure are maintained.

Run the metering system pump for about 15 minutes with the orifice manometer indicating a median reading as expected in field use to allow the pump to warm up and to permit the interior surface of the wet test meter to be thoroughly wetted. Then, at each of a minimum of three orifice manometer settings, pass an exact quantity of gas through the wet test meter and note the gas volume indicated by the dry gas meter. Also note the barometric pressure, and the temperatures of the wet test meter, the inlet of the dry gas meter, and the outlet of the dry gas meter. Select the highest and lowest orifice settings to bracket the expected field operating range of the orifice. Use a minimum volume of 0.15 m³ (5 cf) at all orifice settings. Record all the data on a form similar to Figure 5.6, and calculate Y , the dry gas meter calibration factor, and $^H@$, the orifice calibration factor, at each orifice setting as shown on Figure 5.6. Allowable tolerances for individual Y and $^H@$ values are given in Figure 5.6. Use the average of the Y values in the calculations in Section 6.

Illustration appears only in printed copy. Part 60, pages 565-566.

Before calibrating the metering system, it is suggested that a leak-check be conducted. For metering systems having diaphragm pumps, the normal leak-check procedure will not detect leakages within the pump. For these cases the following leak-check procedure is suggested: make a 10-minute calibration run at 0.00057 m³/min (0.02 cfm); at the end of the run, take the difference of the measured wet test meter and dry gas meter volumes; divide the difference by 10, to get the leak rate. The leak rate should not exceed 0.00057 m³/min (0.02 cfm).

5.3.2 Calibration After Use After each field use, the calibration of the metering system shall be checked by



performing three calibration runs at a single, intermediate orifice setting (based on the previous field test), with the vacuum set at the maximum value reached during the test series. To adjust the vacuum, insert a valve between the wet test meter and the inlet of the metering system. Calculate the average value of the dry gas meter calibration factor. If the value has changed by more than 5 percent, recalibrate the meter over the full range of orifice settings, as previously detailed.

Alternative procedures, e.g., rechecking the orifice meter coefficient may be used, subject to the approval of the Administrator.

5.3.3 Acceptable Variation in Calibration. If the dry gas meter coefficient values obtained before and after a test series differ by more than 5 percent, the test series shall either be voided, or calculations for the test series shall be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

5.4 Probe Heater Calibration. The probe heating system shall be calibrated before its initial use in the field.

Use a heat source to generate air heated to selected temperatures that approximate those expected to occur in the sources to be sampled. Pass this air through the probe at a typical sample flow rate while measuring the probe inlet and outlet temperatures at various probe heater settings. For each air temperature generated, construct a graph of probe heating system setting versus probe outlet temperature. The procedure outlined in APTD-0576 can also be used. Probes constructed according to APTD-0581 need not be calibrated if the calibration curves in APTD-0576 are used. Also, probes with outlet temperature monitoring capabilities do not require calibration.

5.5 Temperature Gauges. Use the procedure in Section 4.3 of Method 2 to calibrate in-stack temperature gauges. Dial thermometers, such as are used for the dry gas meter and condenser outlet, shall be calibrated against mercury-in-glass thermometers.

5.6 Leak Check of Metering System Shown in Figure 5-1. That portion of the sampling train from the pump to the orifice meter should be leak checked prior to initial use and after each shipment.

Leakage after the pump will result in less volume being recorded than is actually sampled. The following procedure is



suggested (see Figure 5-4): Close the main valve on the meter box. Insert a one-hole rubber stopper with rubber tubing attached into the orifice exhaust pipe. Disconnect and vent the low side of the orifice manometer. Close off the low side orifice tap. Pressurize the system to 13 to 18 cm (5 to 7 in.) water column by blowing into the rubber tubing. Pinch off the tubing and observe the manometer for one minute. A loss of pressure on the manometer indicates a leak in the meter box; leaks, if present, must be corrected.

5.7 Barometer. Calibrate against a mercury barometer.

6. Calculations

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after the final calculation. Other forms of the equations may be used as long as they give equivalent results.

Illustration appears only in printed copy. Part 60, page 568.

6.1 Nomenclature.

A_n =Cross-sectional area of nozzle, m^2 (ft^2).

B_{ws} =Water vapor in the gas stream, proportion by volume.

C_a =Acetone blank residue concentration, mg/mg .

c_s =Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, $g/dscm$ ($g/dscf$).

I =Percent of isokinetic sampling.

L_a =Maximum acceptable leakage rate for either a pretest leak check or for a leak check following a component change; equal to 0.00057 m^3/min (0.02 cfm) or 4 percent of the average sampling rate, whichever is less.

L_i =Individual leakage rate observed during the leak check conducted prior to the "ith" component change ($i=1, 2, 3 \dots n$), m^3/min (cfm).



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L_p =Leakage rate observed during the post-test leak check, m³/min (cfm).

m_a =Mass of residue of acetone after evaporation, mg.

m_n =Total amount of particulate matter collected, mg.

M_w =Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).

P_{bar} =Barometric pressure at the sampling site, mm Hg (in. Hg).

P_s =Absolute stack gas pressure, mm Hg (in. Hg).

P_{std} =Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R =Ideal gas constant, 0.06236 mm Hg-m³/°K-g-mole (21.85 in.
Hg-ft³/°R-lb-mole).

T_m =Absolute average dry gas meter temperature (see Figure 5-2), °K (°R).

T_s =Absolute average stack gas temperature (see Figure 5-2), °K (°R).

T_{std} =Standard absolute temperature, 293° K (528° R).

V_a =Volume of acetone blank, ml.

V_{aw} =Volume of acetone used in wash, ml.

V_{lc} =Total volume of liquid collected in impingers and silica gel (see Figure 5-3), ml.

V_m =Volume of gas sample as measured by dry gas meter, dcm (dscf).

$V_m(std)$ =Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

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$V_w(std)$ =Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).

v_s =Stack gas velocity, calculated by Method 2, Equation 2-9, using data obtained from Method 5, m/sec (ft/sec).

W_a =Weight of residue in acetone wash, mg.

Y =Dry gas meter calibration factor.

ΔH =Average pressure differential across the orifice meter (see Figure 5-2), mm H₂O (in. H₂O).

a =Density of acetone, mg/ml (see label on bottle).

w =Density of water, 0.9982 g/ml (0.002201 lb/ml).

α =Total sampling time, min.

α_1 =Sampling time interval, from the beginning of a run until the first component change, min.

α_i =Sampling time interval, between two successive component changes, beginning with the interval between the first and second changes, min.

α_p =Sampling time interval, from the final (nth) component change until the end of the sampling run, min.

13.6=Specific gravity of mercury.

60=Sec/min.

100=Conversion to percent.

6.2 Average Dry Gas Meter Temperature and Average Orifice Pressure Drop. See data sheet (Figure 5-2)

6.3 Dry Gas Volume. Correct the sample volume measured by the dry gas meter to standard conditions (20° C, 760

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mm Hg or 68° F, 29.92 in. Hg) by using Equation 5-1.

$$V_m(\text{std}) = V_m Y \left(\frac{P_{\text{bar}} + \frac{\Delta H}{13.6}}{T_m P_{\text{std}}} \right) = K_1 V_m Y \frac{P_{\text{bar}} + (\Delta H/13.6)}{T_m}$$

Equation 5-1

Where;

$K_1 = 0.3858 \text{ } ^\circ\text{K/mm Hg}$ for metric units

$= 17.64 \text{ } ^\circ\text{R/in. Hg}$ for English units

Note: Equation 5-1 can be used as written unless the leakage rate observed during any of the mandatory leak checks (i.e., the post-test leak check or leak checks conducted prior to component changes) exceeds L_a . If L_p or i exceeds L_a , Equation 5-1 must be modified as follows:

- (a) Case I. No component changes made during sampling run.

In this case, replace V_m in Equation 5-1 with the expression:

$$[V_m - (L_p - L_a)\Theta]$$



- (b) Case II. One or more component changes made during the sampling run. In this case, replace V_m in Equation 5-1 by the expression:

$$V_m - (L_i - L_a)\Theta_i - \sum_{i=2}^n (L_i - L_a)\Theta_i - (L_p - L_a)\Theta_p$$

and substitute only for those leakage rates (L_i or L_p) which exceed L_a .

6.4 Volume of Water Vapor.

$$V_w(\text{std}) = \frac{V_{lc} R H_{Ow}}{M_w P_{\text{std}}} = K_2 V_{lc}$$

Eq. 5-2

Where:

$K_2 = 0.001333 \text{ m}^3/\text{ml}$ for metric units

$= 0.04707 \text{ ft}^3/\text{ml}$ for English units.

6.5 Moisture Content.

$$B_{ws} = \frac{V_w(\text{std})}{V_m(\text{std}) + V_w(\text{std})}$$

Eq. 5-3

Note. In saturated or water droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one from the impinger analysis (Equation 5-3), and a second from the assumption of saturated conditions. The



lower of the two values of Bws shall be considered correct. The procedure for determining the moisture content based upon assumption of saturated conditions is given in the Note of Section 1.2 of Method 4. For the purposes of this method, the average stack gas temperature from Figure 5-2 may be used to make this determination, provided that the accuracy of the in-stack temperature sensor is $\pm 1^\circ\text{C}$ (2°F).

6.6 Acetone Blank Concentration.

$$Ca = \frac{ma}{Va \text{ RHOa}} \quad \text{Eq. 5-4}$$

6.7 Acetone Wash Blank.

$$Wa = Ca Vaw \text{ RHOa} \quad \text{Eq. 5-5}$$

6.8 Total Particulate Weight. Determine the total particulate catch from the sum of the weights obtained from Containers 1 and 2 less the acetone blank (see Figure 5-3).

Note: Refer to Section 4.1.5 to assist in calculation of results involving two or more filter assemblies or two or more sampling trains.

6.9 Particulate Concentration.

$$cs = (0.001 \text{ g/mg}) (mn/Vm \text{ (std)}) \quad \text{Eq. 5-6}$$

6.10 Conversion Factors:

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From	To	Multiply by
scf	m ³	0.02832
g	mg	0.001
g/ft ³	g/ft ³	15.43
g/ft ³	lb/ft ³	2.205x10 ⁻³
g/ft ³	g/m ³	35.31

6.11 Isokinetic Variation.

6.11.1 Calculation From Raw Data.

$$I = \frac{100 Ts [K3 Vlc + (Vm Y/Tm)(Pbar + H/13.6)]}{60 Qvs Ps An} \quad \text{Eq. 5-7}$$

Where.

K3=0.003454 mm Hg-m³/ml-°K for metric units.

=0.002669-in. Hg-ft³/ml-°R for English units.

6.11.2 Calculation From Intermediate Values.

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$$100 T_s V_m(\text{std}) P_{\text{std}}$$

$$I = \frac{60 T_{\text{std}} V_s \Theta A_n P_s (1 - B_w s)}{K_4 T_s V_m(\text{std})}$$

$$P_s V_s A_n \Theta (1 - B_w s)$$

Eq. 5-8

Where:

K₄=4.320 for metric units

=0.09450 for English units.

6.12 Acceptable Results. If 90 percent ≤ I ≤ 110 percent, the results are acceptable. If the particulate results are low in comparison to the standard, and I is over 110 percent or less than 90 percent, the Administrator may accept the results.

Citation 4 in the bibliography section can be used to make acceptability judgments. If I is judged to be unacceptable, reject the particulate results and repeat the test.

6.13 Stack Gas Velocity and Volumetric Flow Rate. Calculate the average stack gas velocity and volumetric flow rate, if needed, using data obtained in this method and the equations in Sections 5.2 and 5.3 of Method 2.

7. Alternative Procedures

7.1 Dry Gas Meter as a Calibration Standard. A dry gas meter may be used as a calibration standard for volume measurements in place of the wet test meter specified in Section 5.3, provided that it is calibrated initially and recalibrated periodically as follows:

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7.1.1 Standard Dry Gas Meter Calibration.

7.1.1.1 The dry gas meter to be calibrated and used as a secondary reference meter should be of high quality and have an appropriately sized capacity, e.g., 3 liters/rev (0.1 ft³/rev). A spirometer (400 liters or more capacity), or equivalent, may be used for this calibration, although a wet test meter is usually more practical. The wet test meter should have a capacity of 30 liters/rev (1 ft³/rev) and capable of measuring volume to within ±1.0 percent; wet test meters should be checked against a spirometer or a liquid displacement meter to ensure the accuracy of the wet test meter. Spirometers or wet test meters of other sizes may be used, provided that the specified accuracies of the procedure are maintained.

7.1.1.2 Set up the components as shown in Figure 5.7. A spirometer, or equivalent, may be used in place of the wet test meter in the system. Run the pump for at least 5 minutes at a flow rate of about 10 liters/min (0.35 cfm) to condition the interior surface of the wet test meter. The pressure drop indicated by the manometer at the inlet side of the dry gas meter should be minimized [no greater than 100 mm H₂O (4 in. H₂O) at a flow rate of 30 liters/min (1 cfm)]. This can be accomplished by using large diameter tubing connections and straight pipe fittings. Illustration appears only in printed copy. Part 60, page 571.

7.1.1.3 Collect the data as shown in the example data sheet (see Figure 5-8). Make triplicate runs at each of the flow rates and at no less than five different flow rates. The range of flow rates should be between 10 and 34 liters/min (0.35 and 1.2 cfm) or over the expected operating range. Illustration appears only in printed copy. Part 60, page 572.

7.1.1.4 Calculate flow rate, Q, for each run using the wet test meter gas volume, V_w, and the run time, Θ. Calculate the dry gas meter coefficient, Y_{ds}, for each run. These calculations are as follows:

$$Q = K_1 \frac{P_{\text{bar}} V_w}{t_w + t_{\text{std}} \Theta}$$

$$Y_{ds} = \frac{V_w (t_{\text{std}} + t_{\text{std}})}{P_{\text{bar}}}$$

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$$Y_{ds} = \frac{V_{ds} (t_w + t_{std}) (P_{bar} + \frac{\Delta p}{13.6})}{\Theta}$$

Where:

KI=0.3858 for international system of units (SI); 17.64 for English units.

V_w=Wet test meter volume, liters (l3).

V_d=Dry gas meter volume, liters (l3).

t_d=Average dry gas meter temperature, °C (°F).

t_{std}=273° C for SI units; 460° F for English units.

t_w=Average wet test meter temperature, °C (°F).

P_{bar}=Barometric pressure, mm Hg (in. Hg).

Δp=Dry gas meter inlet differential pressure, mm H₂O (in. H₂O).

Θ=Run time, min.

7.1.1.5 Compare the three Y_ds values at each of the flow rates and determine the maximum and minimum values. The difference between the maximum and minimum values at each flow rate should be no greater than 0.030. Extra sets of triplicate runs may be made in order to complete this requirement. In addition, the meter coefficients should be between 0.95 and 1.05. If these specifications cannot be met in three sets of successive triplicate runs, the meter is not suitable as a calibration standard and should not be used as such. If these specifications are met, average the three Y_ds values at each flow rate resulting in five average meter coefficients, Y_ds.



7.1.1.6 Prepare a curve of meter coefficient, Y_ds, versus flow rate, Q, for the dry gas meter. This curve shall be used as a reference when the meter is used to calibrate other dry gas meters and to determine whether recalibration is required.

7.1.2 Standard Dry Gas Meter Recalibration.

7.1.2.1 Recalibrate the standard dry gas meter against a wet test meter or spirometer annually or after every 200 hours of operation, whichever comes first. This requirement is valid provided the standard dry gas meter is kept in a laboratory and, if transported, cared for as any other laboratory instrument.

Abuse to the standard meter may cause a change in the calibration and will require more frequent recalibrations.

7.1.2.2 As an alternative to full recalibration, a two-point calibration check may be made. Follow the same procedure and equipment arrangement as for a full recalibration, but run the meter at only two flow rates [suggested rates are 14 and 28 liters/min (0.5 and 1.0 cfm)]. Calculate the meter coefficients for these two points, and compare the values with the meter calibration curve. If the two coefficients are within ±1.5 percent of the calibration curve values at the same flow rates, the meter need not be recalibrated until the next date for a recalibration check.

7.2 Critical Orifices As Calibration Standards. Critical orifices may be used as calibration standards in place of the wet test meter specified in Section 5.3, provided that they are selected, calibrated, and used as follows:

7.2.1 Section of Critical Orifices.

7.2.1.1 The procedure that follows describes the use of hypodermic needles or stainless steel needle tubings which have been found suitable for use as critical orifices. Other materials and critical orifice designs may be used provided the orifices act as true critical orifices; i.e., a critical vacuum can be obtained, as described in Section 7.2.2.3. Select five critical orifices that are appropriately sized to cover the range of flow rates between 10 and 34 liters/min or the



expected operating range.

Two of the critical orifices should bracket the expected operating range.

A minimum of three critical orifices will be needed to calibrate a Method 5 dry gas meter (DGM); the other two critical orifices can serve as spares and provide better selection for bracketing the range of operating flow rates. The needle sizes and tubing lengths shown below give the following approximate flow rates:

Gauge/cm	Flow rate (liters/ min)	Gauge/cm	Flow rate (liters/ min)
12/7.6	32.56	14/2.5	19.54
12/10.2	30.02	14/5.1	17.27
13/2.5	25.77	14/7.6	16.14
13/5.1	23.50	15/3.2	14.16
13/7.6	22.37	15/7.6	11.61
13/10.2	20.67	15/10.2	10.48

7.2.1.2 These needles can be adapted to a Method 5 type sampling train as follows: Insert a serum bottle stopper, 13-by 20-mm sleeve type, into a 1/2-inch Swagelok quick connect. Insert the needle into the stopper as shown in Figure 5-9.

Illustration appears only in printed copy. Part 60, page 574.

7.2.2 Critical Orifice Calibration. The procedure described in this section uses the Method 5 meter box configuration with a DGM as described in Section 2.1.8 to calibrate the critical orifices. Other schemes may be used, subject to the



approval of the Administrator.

7.2.2.1 Calibration of Meter Box. The critical orifices must be calibrated in the same configuration as they will be used; i.e., there should be no connections to the inlet of the orifice.

7.2.2.1.1 Before calibrating the meter box, leak check the system as follows: Fully open the coarse adjust valve, and completely close the by-pass valve. Plug the inlet. Then turn on the pump, and determine whether there is any leakage. The leakage rate shall be zero; i.e., no detectable movement of the DGM dial shall be seen for 1 minute.

7.2.2.1.2 Check also for leakages in that portion of the sampling train between the pump and the orifice meter. See Section 5.6 for the procedure; make any corrections, if necessary. If leakage is detected, check for cracked gaskets, loose fittings, worn O-rings, etc., and make the necessary repairs.

7.2.2.1.3 After determining that the meter box is leakless, calibrate the meter box according to the procedure given in Section 5.3. Make sure that the wet test meter meets the requirements stated in Section 7.1.1.1. Check the water level in the wet test meter. Record the DGM calibration factor, Y.

7.2.2.2 Calibration of Critical Orifices. Set up the apparatus as shown in Figure 5-10.

Illustration appears only in printed copy. Part 60, page 575.

7.2.2.2.1 Allow a warm-up time of 15 minutes. This step is important to equilibrate the temperature conditions through the DGM.

7.2.2.2.2 Leak check the system as in Section 7.2.2.1.1.

The leakage rate shall be zero.

7.2.2.2.3 Before calibrating the critical orifice, determine its suitability and the appropriate operating vacuum as follows: Turn on the pump, fully open the coarse adjust valve, and adjust the by-pass valve to give a vacuum reading corresponding to about half of atmospheric pressure. Observe the meter box orifice manometer reading, H. Slowly



increase the vacuum reading until a stable reading is obtained on the meter box orifice manometer.

Record the critical vacuum for each orifice.

Orifices that do not reach a critical value shall not be used.

7.2.2.2.4 Obtain the barometric pressure using a barometer as described in Section 2.1.9. Record the barometric pressure, P_{bar} , in mm Hg (in. Hg).

7.2.2.2.5 Conduct duplicate runs at a vacuum of 25 to 50 mm Hg (1 to 2 in. Hg) above the critical vacuum. The runs shall be at least 5 minutes each. The DGM volume readings shall be in increments of 0.00283 m³ (0.1 ft³) or in increments of complete revolutions of the DGM. As a guideline, the times should not differ by more than 3.0 seconds (this includes allowance for changes in the DGM temperatures) to achieve ± 0.5 percent in K' . Record the information listed in Figure 5-11.

7.2.2.2.6 Calculate K' using Equation 5-9.

Eq. 5-9

$$K' = \frac{K' V_m Y (P_{bar} + H/13.6) \sqrt{T_{amb}}}{P_{bar} T_m \Theta}$$

$$K' = \frac{K' V_m Y (P_{bar} + H/13.6) \sqrt{T_{amb}}}{P_{bar} T_m \Theta}$$

Where:

$$\frac{(m^3)(^\circ K)^{1/2}}{(ft^3)(^\circ R)^{1/2}}$$

$$K' = \text{Critical orifice coefficient, } \frac{(mm. Hg)(min)}{(in. Hg)(min)}$$



T_{amb} = Absolute ambient temperature, $^\circ K$ ($^\circ R$).

Average the K' values. The individual K' values should not differ by more than ± 0.5 percent from the average.

7.2.3 Using the Critical Orifices as Calibration Standards.

7.2.3.1 Record the barometric pressure.

Date ____ Train ID ____ DGM cal. factor ____ Critical orifice ID ____

Dry gas meter		Run number:	
		1	2
Final reading.....	m ³ (ft ³).....		
Initial reading.....	m ³ (ft ³).....		
Difference, V_m	m ³ (ft ³).....		
Inlet/Outlet temperatures:			
Initial.....	$^\circ C$ ($^\circ F$).....	/	/
Final.....	$^\circ C$ ($^\circ F$).....	/	/
Avg. Temperature, T_m	$^\circ C$ ($^\circ F$).....		
Time, Θ	min/sec.....	/	/
Orifice man. rdg., $^{\circ}H$	mm (in.) H ₂ O.....		
Bar. pressure, P_{bar}	mm (in.) Hg.....		
Ambient temperature, T_{amb}	$^\circ C$ ($^\circ F$).....		
Pump vacuum.....	mm (in.) Hg.....		
K' factor.....			



Average..... 1 1 1

Figure 5-11. Data sheet for determining K' factor.

7.2.3.2 Calibrate the metering system according to the procedure outlined in Sections 7.2.2.2.1 to 7.2.2.2.5. Record the information listed in Figure 5.12.

7.2.3.3 Calculate the standard volumes of air passed through the DGM and the critical orifices, and calculate the DGM calibration factor, Y, using the equations below:

$$V_m(\text{std}) = K1 V_m \frac{P_{\text{bar}} \Theta}{T_m} \quad \text{Eq. 5-10}$$

$$V_{\text{cr}}(\text{std}) = K' \frac{P_{\text{bar}} \Theta}{\sqrt{T_{\text{amb}}}} \quad \text{Eq. 5-11}$$

$$Y = \frac{V_{\text{cr}}(\text{std})}{V_m(\text{std})} \quad \text{Eq. 5-12}$$

where:

$V_{\text{cr}}(\text{std})$ = Volume of gas sample passed through the critical orifice, corrected to standard conditions, dsm3 (dscf).

$K1 = 0.3858 \text{ } ^\circ\text{K/mm Hg}$ for metric units

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=17.64 $^\circ\text{R/in. Hg}$ for English units.

7.2.3.4 Average the DGM calibration values for each of the flow rates. The calibration factor, Y, at each of the flow rates should not differ by more than ± 2 percent from the average.

7.2.3.5 To determine the need for recalibrating the critical orifices, compare the DGM Y factors obtained from two adjacent orifices each time a DGM is calibrated; for example, when checking 13/2.5, use orifices 12/10.2 and 13/5.1. If any critical orifice yields a DGM Y factor differing by more than 2 percent from the others, recalibrate the critical orifice according to Section 7.2.2.2.

Date ____ Train ID ____ Critical orifice ID ____ Critical orifice K' factor ____

Dry gas meter		Run number	
		1	2
Final reading.....	m3 (ft3).....		
Initial reading.....	m3 (ft3).....		
Difference, V_m	m3 (ft3).....		
Inlet/outlet temperatures:			
Initial.....	$^\circ\text{C}$ ($^\circ\text{F}$).....	/	/
Final.....	$^\circ\text{C}$ ($^\circ\text{F}$).....	/	/
Avg. Temperature, t_m	$^\circ\text{C}$ ($^\circ\text{F}$).....		
Time, Θ	min/sec.....	/	/
Orifice man. rdg., ΔH	mm (in.) H ₂ O.....		
Bar. pressure, P_{bar}	mm (in.) Hg.....		
Ambient temperature, t_{amb}	$^\circ\text{C}$ ($^\circ\text{F}$).....		
Pump vacuum.....	mm (in.) Hg.....		

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Vm(std).....	m3 (ft3).....		
Vcr(std).....	m3 (ft3).....		
DGM cal. factor, Y.....		

Figure 5-12. Data sheet for determining DGM Y factor.

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APPENDIX C
CHAIN-OF-CUSTODY RECORD

ATTACHMENT A
ADMINISTRATIVE ORDER BY CONSENT

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

IN THE MATTER OF:	)	Docket No.
)	
COMMERCIAL OIL SERVICES	)	ADMINISTRATIVE ORDER BY
SITE, OH	)	CONSENT PURSUANT TO
	)	SECTIONS 106 AND 122 OF
	)	THE COMPREHENSIVE
Respondents:	)	ENVIRONMENTAL RESPONSE,
	)	COMPENSATION AND
	)	LIABILITY ACT OF 1980,
Listed in Appendices A, B, C & D	)	AS AMENDED, 42 U.S.C.
	)	SECTION 9606(a) AND 9622

PREAMBLE

The United States Environmental Protection Agency (U.S. EPA), the Respondents, Capped De Minimis Respondents, De Minimis Respondents and Federal Agency Respondents have each agreed to the making and entry of this Administrative Order by Consent "Consent Order". The Respondents, Capped De Minimis Respondents, and De Minimis Respondents have also each entered into the Commercial Oil Services Site Participation Agreement.

This Consent Order is issued pursuant to the authority vested in the President of the United States by Sections 106(a), 122(g)(4) and 122(h) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. Section 9606(a), 9622(g)(4) and 9622(h), as amended by the Superfund Amendments and Reauthorization Act of 1986, Pub. L. 99-499 (hereinafter referred to collectively as CERCLA), Section 7003(a) of the Resource Conservation and Recovery Act, 42 U.S.C. 6973(a) and delegated to the Administrator of the U.S. EPA by Executive Order No. 12580, January 23, 1987, 52 Federal Register 2923, and further delegated to the Assistant Administrator for Solid Waste and Emergency Response and the Regional Administrators by U.S. EPA Delegation Nos. 14-14, 14-14-C, 14-14-D and 14-14-F.

A copy of this Consent Order will also be provided to the State of Ohio, which has been notified of the issuance of this Consent Order as required by Section 106(a) of CERCLA, 42 U.S.C. Section 9606(a).

This Consent Order requires the Respondents identified in Appendix A to undertake and complete removal activities to abate conditions which may present an imminent and substantial endangerment to the public health or welfare or the environment because of an actual or threatened release of hazardous

substances at the Commercial Oil Services Site in Oregon, Ohio and to reimburse past response costs and future oversight response costs of U.S. EPA.

This Consent Order requires the Capped De Minimis Respondents identified in Appendix B, the De Minimis Respondents identified in Appendix C and the Federal Agency Respondents identified in Appendix D to pay specified amounts of money in settlement, which shall be used to pay for performance and completion of work specified in this Consent Order and to reimburse past response costs and oversight response costs incurred at the Commercial Oil Services Site.

The Respondents, Capped De Minimis Respondents, De Minimis Respondents and Federal Agency Respondents agree not to contest the jurisdiction of U.S. EPA to issue or enforce this Consent Order in any action taken to enforce this Consent Order. Each Respondent, Capped De Minimis Respondent, De Minimis Respondent and Federal Agency Respondent agrees to undertake all actions and obligations required by the terms and conditions of this Consent Order.

DEFINITIONS

Whenever the following terms are used in this Consent Order or the Appendices attached hereto, the following definitions specified in this section shall apply:

a. "CERCLA" shall mean the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 ("SARA"), 42 U.S.C. Sections 9601 et seq.

b. "Capped De Minimis Respondents" shall mean those parties listed in Appendix B, who have contributed less than 1% of the total waste sent to the Commercial Oil Services Site and who have signed this Consent Order and the Commercial Oil Services Participation Agreement as a Capped De Minimis Respondent.

c. "Day" shall mean a calendar day unless expressly stated to be a working day. "Working day" shall mean a day other than a Saturday, Sunday, or Federal holiday. In computing any period of time under this Consent Order, where the last day would fall on a Saturday, Sunday, or Federal holiday, the period shall run until the close of business of the next working day.

d. "De Minimis Respondents" shall mean those parties listed in Appendix C, who have each contributed less than 1% of the total waste sent to the Commercial Oil Services Site and who have signed this Consent Order and the Commercial Oil Services Participation Agreement as a De Minimis Respondent.

e. "Federal Agency Respondents" shall mean the U.S. Postal Service and the U.S. Coast Guard, as listed in Appendix D, and

who have each contributed less than 1% of the total waste sent to the Commercial Oil Services Site and who have signed this Consent Order.

f. "Final Design Reports" shall mean the documents submitted by the Respondents pursuant to this Consent Order and described more fully in the Work Plan.

g. "National Contingency Plan" or "NCP" shall mean the National Oil and Hazardous Substances Pollution Contingency Plan promulgated pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, codified at 40 C.F.R. Part 300, including, but not limited to, any amendments thereto.

h. "Oversight Response Costs" shall mean all costs, not inconsistent with the NCP, including, but not limited to, direct and indirect costs, that U.S. EPA incurs in reviewing or developing plans, reports and other items pursuant to this Consent Order, verifying the Work, or otherwise implementing, overseeing or enforcing this Consent Order, including, but not limited to, payroll costs, contractor costs, travel costs, laboratory costs, the costs incurred pursuant to Paragraphs 10 through 12 (including, but not limited to, attorneys fees and the amount of just compensation), 15 through 17 and 51. Oversight Response Costs shall also include all costs, including direct and indirect costs, not inconsistent with the NCP, paid by the U.S. EPA in connection with the Site between September 30, 1992, and the effective date of this Consent Order and all interest on the Past Response Costs from October 26, 1992 to the date of payment of the Past Response Costs.

i. "Hazardous Substance" shall have the meaning provided in Section 101(14) of CERCLA, 42 U.S.C. Section 9601(14).

j. "Parties" shall mean the United States Environmental Protection Agency, Respondents, Capped De Minimis Respondents, De Minimis Respondents and Federal Agency Respondents.

k. "Past Response Costs" shall mean all costs, not inconsistent with the NCP, including, but not limited to, direct and indirect costs and interest, that the U.S. EPA incurred and paid with regard to the Site prior to September 30, 1992, which equal \$2,446,539.92.

l. "Performance Standards" shall mean those cleanup standards, standards of control, and other substantive requirements, criteria or limitations set forth in the Work Plan attached hereto as Appendix E.

m. "Potentially Responsible Party" or "PRP" shall mean all persons, as that term is defined in Section 101(21) of CERCLA, 42 U.S.C. Section 9601(21), who are potentially liable to the United

5. According to the Part A RCRA Permit Application submitted by Commercial Oil Services, K049 and K051 hazardous wastes were listed for disposal in surface lagoons at the Site, and F002, F003, F005, K049, and K051 hazardous wastes were disposed in tanks and containers at the Site. In a letter to Ohio EPA, dated September 21, 1983, the President of Commercial Oil Services stated that the lagoons had not been used for disposal and storage of hazardous waste.

6. In 1985, Commercial Oil Services ceased operations at the Site and filed for bankruptcy.

7. U.S. EPA has conducted the following activities in responding to releases and threatened releases from the surface lagoons at the Commercial Oil Services Site as part of its removal action: a) Transfer of water between lagoons to prevent offsite migration; b) Cleanup of PCB contaminated oil in soils; c) Treatment of surface lagoon water and subsequent discharge to adjacent surface water.

8. In December 1986, U.S. EPA initiated an engineering evaluation of the Site.

9. On June 30, 1988, U.S. EPA and 30 of the potentially responsible parties (PRPs) identified at the Site entered into an Administrative Order on Consent ("Phase I Order") which required the respondents to that Order to perform a number of necessary response actions including the performance of an engineering evaluation and cost analysis (EE/CA) study.

10. On November 18, 1988, the Phase I Order was amended to allow 13 additional respondents to the Order. The Order was subsequently amended two additional times to extend the time period under which the Phase I respondents were obligated to conduct freeboard maintenance activities at the Site.

11. Pursuant to the Phase I Order and First, Second and Third Amendments to the Order dated November 18, 1988, November 9, 1989 and June 6, 1991, respectively, the Phase I respondents removed drums and associated debris, and, through three separate water treatment actions, treated in excess of 22 million gallons of water and prevented the overtopping of the tank farm containment structure and lagoons. The Phase I respondents also initiated a detailed examination of Commercial Oil Service's business records for the purpose of identifying additional PRPs. The Phase I respondents incurred costs in the amount of \$5,579,243.11 associated with Phase I implementation.

12. The results from the EE/CA sampling of the lagoon sludge and clay subsoil at the Site conclude that the surface lagoon sludges are contaminated with hazardous substances including vinyl

chloride, benzene, naphthalene, PCBs, chromium, lead, trichloroethylene, trichloroethane, toluene, xylene and zinc.

13. On June 9, 1991, U.S. EPA issued its Proposed Removal Action Plan which proposed treatment of the lagoon sludge contained in the surface impoundments through solidification/stabilization, construction of a RCRA cap over the surface lagoons, and post-closure requirements including groundwater monitoring. Public comment was accepted on the proposed removal action plan until October 8, 1991.

14. On November 12, 1992, U.S. EPA issued an Action Memorandum which selected a removal response action to be implemented at the Site.

15. Pursuant to the Phase I Order, the Phase I respondents prepared a Work Plan to implement the removal action specified in the November 12, 1992 Action Memorandum. With U.S. EPA approval of the Work Plan, the Phase I Respondents have complied with their obligations under the Phase I Order.

16. U.S. EPA has secured access to the Site for itself, Respondents and their respective contractors, agents and consultants. At this time, no additional access agreements are anticipated to be necessary.

DETERMINATIONS

Based on the foregoing Findings, U.S. EPA has determined that:

1. The Commercial Oil Services Site is a "facility" as defined by Section 101(9) of CERCLA, 42 U.S.C. Section 9601(9).
2. Each Respondent, Capped De Minimis Respondent, De Minimis Respondent and Federal Agency Respondent is a "person" as defined by Section 101(21) of CERCLA, 42 U.S.C. Section 9601(21).
3. Each Respondent, Capped De Minimis Respondent, De Minimis Respondent and Federal Agency Respondent arranged for disposal or transport for disposal of hazardous substances at the Commercial Oil Services facility, or is a past or present owner or operator of the facility. Each respondent is, therefore, a liable person under Section 107(a) of CERCLA, 42 U.S.C. Section 9607(a).
4. Vinyl Chloride, benzene, naphthalene, PCBs, chromium, lead and zinc, trichloroethylene, toluene and xylene are "hazardous substances" as defined by Section 101(14) of CERCLA, 42 U.S.C. Section 9601(14).
5. The presence of hazardous substances in the Site's lagoon sludge and subsurface clay soil constitutes an actual or

threatened "release" as that term is defined in Section 101(22) of CERCLA, 42 U.S.C. Section 9601(22).'

6. The actual or threatened release of hazardous substances from the Facility may present an imminent and substantial endangerment to the public health, welfare, or the environment.

7. The actions required by this Consent Order, if properly performed, are consistent with CERCLA and the National Contingency Plan (NCP), 40 CFR Part 300, as amended; and are reasonable and necessary to protect the public health, welfare and the environment because of the following factors:

- a. actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, pollutants or contaminants;

This factor is present at the Facility due to the existence of a threat of direct exposure to hazardous substances as a result of the surface lagoon sludge and liquids coming in contact with skin, or from direct ingestion of these sludges or liquids. In September 1992, approximately twenty-five Canadian Geese came into contact with PCB-contaminated oils present in the surface impoundments. The geese were destroyed because of the threat to human health and the environment via the food chain. Animals could introduce these contaminants into the food chain. PCBs are capable of causing both short-term and long-term local and systemic health effects in humans. They are also known to bioaccumulate in the food chain.

- b. actual or potential contamination of drinking water supplies or sensitive ecosystems;

This factor is present at the Facility due to the existence of PCBs and other hazardous substances in the sludge of the surface lagoons that may migrate to adjacent soils, surface waters and groundwater.

- c. hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release;

This factor is present at the Facility due to the existence of tanks containing solvents and flammable liquids, including hazardous substances such as trichloroethane, toluene, naphthalene, xylene and chlorobenzene, on Site which pose a threat of release to the adjacent surface waters and the environment.

- d. high levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate;

This factor is present at the Facility due to the existence of PCBs and other hazardous substances in the sludge of the surface lagoons that may migrate to adjacent soils and groundwater. Major contaminants of concern in the sludge of the surface lagoons are PCBs, volatile and semivolatile solvents (including benzene, toluene, xylene, 1,1-dichloroethane, 1,1,1-trichloroethane, ethylbenzene, phenols, phenanthrene, pyrene, phthalate compounds, metals and other toxicity characteristic constituents. The concentration of PCBs in the sludge exceeds the levels set in U.S. EPA "TSCA-PCB Spill Cleanup Policy Final Rule," published at 52 Federal Register 10688, April 2, 1987 and codified at Title 40 CFR Part 761.

- e. weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released;

This factor is present at the Facility due to no secondary containment for the lagoons; the presence of oil on top of the water in the lagoons prevents evaporation and precipitation causes the lagoons to fill and overflow. A release from the Site would Result in the contamination of Otter Creek and subsequently, Lake Erie. In the absence of any preventative measures, weather conditions may cause hazardous substances to be released from the surface lagoons and the tank farm to adjacent surface waters and the environment.

- f. threat of fire or explosion;

This factor is present at the Facility due to the existence of tanks containing solvents and flammable liquids.

8. Based on the Administrative Record, the requirements of Section 122(g), 42 U.S.C. Section 9622(g) are satisfied with regard to the De Minimis settlement because:

- a. The De Minimis settlement embodied in this Consent Order is practicable and in the public interest;
- b. The settlement involves only a minor portion of the response costs at the Site with respect to each Capped De Minimis Respondent, De Minimis Respondent and Federal Agency Respondent;
- c. Information currently known to the U.S. EPA indicates that the amount of hazardous substances contributed to the Site by each Capped De Minimis Respondent, De Minimis Respondent and Federal Agency Respondent does not exceed 1.0% of the hazardous substances at the Site, and that the toxic or other hazardous effects of the hazardous substances contributed to the Site by each Capped De Minimis Respondent, De Minimis Respondent and Federal Agency Respondent do not contribute disproportionately to the cumulative toxic or other hazardous effects of the hazardous substances at the Site; and

d. The amount of hazardous substances contributed to the Site by each Capped De Minimis Respondent, De Minimis Respondent and Federal Agency Respondent and the toxic or other hazardous effects of the hazardous substances contributed to the Site by each Capped De Minimis Respondent, De Minimis Respondent and Federal Agency Respondent are minimal in comparison to other hazardous substances at the Site.

ORDER

Based upon the foregoing Findings and Determinations, and pursuant to Section 106(a) of CERCLA, 42 U.S.C. Section 9606(a), it is hereby ordered and agreed that Respondents shall undertake the following actions:

1. Respondents have submitted and U.S. EPA has approved a Work Plan for the removal activities to be conducted pursuant to this Consent Order. The Work Plan is attached as Appendix E (hereinafter referred to as the "Work Plan").
2. Respondents shall retain a contractor qualified to undertake and complete the design activities specified in the Work Plan, and shall notify U.S. EPA of the name of such contractor within five (5) working days of receipt of notice that this Consent Order is effective. The Respondents shall, in accordance with the schedule set forth in the Work Plan, select and award contracts for the performance of other work required under this Consent Order. U.S. EPA retains the right to disapprove of any, or all, of the contractors and/or subcontractors retained by the Respondent(s). In the event U.S. EPA disapproves of a selected contractor or subcontractor, Respondents shall retain a different contractor to perform the work, and such selection shall be made within thirty (30) days following U.S. EPA's disapproval.
3. Within 5 working days of receipt of notice that this Consent Order is effective, Respondents shall begin to implement the removal activities specified in the Work Plan, attached as Appendix E, as approved by U.S. EPA or modified pursuant to Paragraph 59 of this Consent Order. Failure of the Respondents to fully and properly implement all aspects of the Work Plan shall be deemed to be a violation of the terms of this Consent Order.
4. All materials removed from the Commercial Oil Services Site shall be disposed of or treated at a facility approved by the On-Scene Coordinator and in accordance with the Resource Conservation and Recovery Act of 1976 (RCRA), 42 U.S.C. Section 6901, et seq., as amended, the U.S. EPA Off-Site Policy (OSWER Directive 9834.11, November 13, 1987 and subsequent revisions thereof, SARA Section 121(d)(3) and all other applicable Federal, State, and local requirements.

5. On, or before, the effective date of this Consent Order, the Respondents shall designate a Project Coordinator. The U.S. EPA has designated Partap C. Lall, of the Emergency and Enforcement Response Branch, Response Section I, as its On-Scene Coordinator. The On-Scene Coordinator and the Project Coordinator shall be responsible for overseeing the implementation of this Consent Order. To the maximum extent possible, communication between the Respondents and the U.S. EPA, and all documents, reports and approvals, and all other correspondence concerning the activities relevant to this Consent Order, shall be directed through the On-Scene Coordinator and the Project Coordinator.

6. The U.S. EPA and the Respondents shall each have the right to change their respective designated On-Scene Coordinator or Project Coordinator. U.S. EPA shall notify the Respondents, and Respondents shall notify U.S. EPA, as early as possible before such a change is made. Notification may initially be verbal, but shall promptly be reduced to writing within 5 days of notification.

7. The U.S. EPA On-Scene Coordinator shall have the authority vested in an On-Scene Coordinator by the National Contingency Plan, 40 CFR Part 300, as amended, including the authority to halt, conduct, or direct any work required by this Consent Order, or to direct any other response action undertaken by U.S. EPA or the Respondents at the facility. If Respondents are acting under the direction of the On-Scene Coordinator, Respondents will not be in violation of this Consent Order.

8. No extensions to the time frames in this Consent Order shall be granted without sufficient cause. Respondents shall request all extensions, in writing. An extension shall not be deemed accepted unless approved, in writing, by U.S. EPA.

9. This Consent Order and all instructions by the U.S. EPA On-Scene Coordinator or designated alternate that are consistent with the National Contingency Plan and this Consent Order shall be binding upon the Respondents, Capped De Minimis Respondents, De Minimis Respondents, and their successors and assigns, and Federal Agency Respondents. Respondents, Capped De Minimis Respondents, De Minimis Respondents and Federal Agency Respondents shall be responsible for ensuring that their respective agents, contractors, consultants and any other person acting on their behalf comply with the terms of this Consent Order. Respondents, and to the extent provided in Paragraph 47, the Capped De Minimis Respondents, are jointly and severally responsible for carrying out all actions required by this Consent Order. In the event of the insolvency or other failure of any one or more Respondents, or of the Commercial Oil Services Qualified De Minimis Trust or other Funds, to implement the requirements of this Order, the remaining Respondents shall complete all such requirements.

ACCESS

10. To the extent that the Site or other areas where work under this Consent Order is to be performed is owned by, or in possession of, someone other than the Respondents, Respondents shall attempt to obtain all necessary access agreements. In the event that after using their best efforts Respondents are unable to obtain such agreements, Respondents shall immediately notify U.S. EPA. After receiving such notification, U.S. EPA may then assist such Respondents in gaining access, to the extent necessary to effectuate the response activities described herein, using such means as U.S. EPA deems appropriate. Respondents shall reimburse U.S. EPA for all costs it incurs in assisting Respondents to obtain access. For purposes of this Paragraph "best efforts" includes the payment of reasonable sums of money in consideration of access.

11. Subject to Paragraph 10, Respondents shall provide access to the Site to U.S. EPA employees, and U.S. EPA-authorized contractors, agents, and consultants at anytime, and shall permit such persons to be present and move freely in the area in order to conduct inspections, including taking photographs and videotapes of the Site, to do cleanup/stabilization work, to take samples, to monitor the work under this Consent Order, and to conduct other activities which the U.S. EPA determines to be necessary. Upon Respondents' written request, U.S. EPA shall make such photographs available for copying and shall provide split samples of such sampling activities.

12. Notwithstanding any provision of this Consent Order, the U.S. EPA retains all of its access authorities and rights, including enforcement authorities related thereto, under CERCLA, RCRA and any other applicable statute or regulations.

REPORTS

13. On the 10th day of each month, Respondents shall provide written monthly progress reports to the On-Scene Coordinator regarding the actions and activities undertaken under this Consent Order over the previous month. At a minimum, Respondents shall describe the actions that have been taken to comply with this Consent Order, including all results of sampling and tests received or prepared by the Respondents and shall describe all significant work items planned for the next month in these monthly progress reports.

DOCUMENT RETENTION

14. Respondents agree to retain for six years following completion of the activities required by this Consent Order copies of all records, files and data relating to hazardous substances found on the site, or related to the activities

undertaken pursuant to this Consent Order, whether or not those documents were created pursuant to this Consent Order, including without limitation, records, files and data related to transactions with Commercial Oil Services and formal reports and data associated with Respondents' efforts to comply with the requirements of the Phase I Order and amendments thereto. Respondents shall acquire and retain copies of all documents relating to the site that are in the possession of their contractors, agents and employees. Respondents shall notify U.S. EPA at least sixty (60) days before any documents retained under this paragraph are to be destroyed. Respondents shall make the documents retained under this paragraph available, during normal business hours or other reasonable time, to U.S. EPA upon request.

ADDITIONAL WORK

15. In the event that U.S. EPA determines or the Respondents propose that additional response actions are necessary to meet the Performance Standards identified in the Work Plan, notification of such additional response actions shall be provided to the On-Scene Coordinator and the Project Coordinator for the other party.

16. Within 30 days of receipt of notice from U.S. EPA or Respondents pursuant to Paragraphs 15 through 17 that additional response actions are necessary (or such longer time as may be specified by U.S. EPA), Respondents shall submit for approval by U.S. EPA, a work plan for the additional response actions. Upon approval of the plan, Respondents shall implement the plan for additional response actions in accordance with the schedule contained therein.

17. Any additional response actions that Respondents propose are necessary to meet the Performance Standards shall be subject to approval by U.S. EPA, and, if authorized by U.S. EPA, shall be completed by Respondents in accordance with plans, specifications, and schedules approved or established by U.S. EPA.

DE MINIMIS PAYMENTS

18. Within 20 days after the effective date of this Consent Order, the Respondents shall establish a Commercial Oil Services De Minimis Qualified Trust ("COSDMQT") by executing the COSDMQT in substantially the same form as Appendix F. The Respondents shall use the COSDMQT assets solely to pay proper and necessary expenses pursuant to this Consent Order, including: 1) payment for performance and completion of the Work described in Paragraph 3 and the Work Plan; 2) reimbursement to the U.S. EPA for Past Response Costs and Oversight Response Costs; and 3) payment of proper and necessary expenses to administer each Fund. Within 30

days after the effective date of this Consent Order, Respondents shall submit to U.S. EPA a copy of the signed trust agreement establishing the COSDMQT.

19. Within 30 days after the effective date of this Consent Order, each Capped De Minimis Respondent and each De Minimis Respondent shall pay into the COSDMQT the amount set forth in Appendix G to this Consent Order, which is incorporated herein by reference, that is appropriate for participation as a Capped De Minimis Respondent or De Minimis Respondent. The payment level chosen will affect the covenants not to sue, the reservation of rights, and the contribution related to such respondents in the manner described in Paragraphs 47, 48, and 49 through 57.

20. Within a reasonable period of time after the effective date of this Consent Order, each Federal Agency Respondent shall pay into the COSDMQST the amount that is set forth in Appendix G to this Consent Order that is appropriate for participation as a De Minimis settlor. Payments by Federal Agencies are subject to the availability of appropriated funds. No provision of this Consent Order shall be interpreted as or constitute a commitment or requirement that a Federal Agency obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. Section 1341.

21. The failure of any Capped De Minimis Respondent, De Minimis Respondent or Federal Agency Respondent to make payments required by this Consent Order shall not excuse any failure by Respondents to timely complete the Work or to reimburse costs, as required by this Consent Order.

PUBLIC COMMENT

22. This Consent Order shall be subject to a thirty-day public comment period pursuant to Section 122(i) of CERCLA, 42 U.S.C. 9622(i)(3). EPA may withdraw consent to this Consent Order if comments received disclose facts or considerations which indicate that this Consent Order is inappropriate, improper or inadequate.

REIMBURSEMENT OF RESPONSE COSTS

23. Respondents shall reimburse the United States for all Oversight Response Costs not inconsistent with the National Contingency Plan incurred by the United States related to the Commercial Oil Services Site. The United States shall submit a standard Regionally prepared itemized cost summary to Respondents on a periodic basis. Upon request from Respondents, U.S. EPA will provide copies of contractor progress reports for the billing period, provided that those reports are available and provided that U.S. EPA may determine that part or all of such reports are not releasable under 40 C.F.R. Part 2. Payments shall be made within 60 days of Respondents' receipt of the cost statement. Payments shall be made to the U.S. EPA Hazardous

Substances Superfund delivered to the U.S. EPA, Attn: Superfund Accounting, P.O. Box 70753, Chicago, Illinois 60673, in the form of a certified or cashier's check payable to "U.S. EPA Hazardous Substances Superfund." The face of the check should note that the payment is for the Commercial Oil Services Site, Superfund Site Identification Number 5G. Respondents are jointly and severally liable for payment of the full amount due under this Consent Order. A copy of the check(s) submitted must be sent simultaneously to the U.S. EPA representatives indicated in Paragraphs 24 and 25 below.

24. Within 60 days of the effective date of this Consent Order, Respondents shall pay to the United States \$2,446,539.92, in the form of a certified check or checks made payable to "EPA Hazardous Substance Superfund," and referencing CERCLA Number 5G in reimbursement of Past Response Costs. The Respondents shall forward the certified check to the U.S. EPA Hazardous Substances Superfund, U.S. EPA, Superfund Accounting, P.O. Box 70753, Chicago, Illinois 60673 and shall send copies of the check to the United States and to the Director, Waste Management Division, U.S. EPA, Region V.

SUBMISSIONS REQUIRING APPROVAL

25. A notice, document, information, report, plan, approval, disapproval or other correspondence required to be submitted from one party to another under the Consent Order shall be deemed submitted either when hand delivered or as of the date of receipt by overnight mail. If the last day of any deadline for submission of one of the types of documents referenced in this Paragraph falls on a weekend or holiday, the deadline shall be automatically extended to the next non-holiday weekday. The U.S. EPA and the Respondents shall each have the right to change the officials who receive submissions under this Paragraph. U.S. EPA shall notify the Respondents, and Respondents shall notify U.S. EPA, as early as possible before such a change is made. Notification may initially be verbal, but shall promptly be reduced to writing within 5 days of notification.

Submissions to the U.S. EPA shall be submitted to:

Partap C. Lall
On-Scene Coordinator
U.S. EPA, Region V
Emergency Response Section
9311 Groh Road
Grosse Ile, MI 48138

Richard M. Murawski
Assistant Regional Counsel
U.S. EPA, Region V
Mail Code: CS-3T
77 W. Jackson. Blvd.
Chicago, IL 60604

Submissions to the Respondents shall be submitted to:

Douglas G. Haynam, Esq.
Fuller and Henry
One Seagate, Suite 1700
Toledo, Ohio 43603

DISPUTE RESOLUTION

26. U.S. EPA and Respondents shall attempt to resolve expeditiously and informally any disagreements concerning implementation of this Consent Order or any Work required hereunder.

27. In the event that any dispute arising under this Consent Order is not resolved through informal means, then the position advanced by U.S. EPA shall be considered binding unless, within 14 days after the conclusion of the informal negotiations, Respondents invoke the formal dispute resolution procedures below by serving U.S. EPA a written Statement of Position on the matter in dispute, including, but not limited to, any factual data, analysis or opinion supporting that position and any supporting documentation relied upon by the Respondents. The Statement of Position shall specify the Respondents' position as to whether formal dispute resolution should proceed.

28. Within fourteen (14) calendar days of the Statement of Position pursuant to Paragraph 27 above, U.S. EPA will serve on Respondents its Statement of Position, including, but not limited to, any factual data, analysis, or opinion supporting that position and all supporting documentation relied upon by U.S. EPA. U.S. EPA's Statement of Position shall include a statement as to whether formal dispute resolution should proceed.

29. An administrative record of any dispute under this Section shall be maintained by U.S. EPA. The record shall include the written notification of such dispute, and the Statements of Position served pursuant to the preceding paragraphs.

30. Upon review of the administrative record, the Director of the Waste Management Division, U.S. EPA, Region V, shall resolve the dispute consistent with the NCP and the terms of this Consent Order. The decision, which shall be in writing and made part of the Administrative Record, shall be binding upon the Respondents. Respondents shall retain whatever rights they may have to seek review and appeal the decision, including any and all rights under Section 106 of CERCLA.

STIPULATED PENALTIES

31. For each day the Respondents fail to meet the deadlines set forth in the Consent Order, Work Plan, and Final Design Reports' Construction Work Schedules, Respondents shall be liable as follows:

a. The following stipulated penalties shall be payable per violation per day to U.S. EPA for any non-compliance identified in subparagraph b:

<u>Penalty Per Violation Per Day</u>	<u>Period of Noncompliance</u>
\$1000	Up to 30 Days
\$3000	31 to 60 Days
\$6000	Over 60 Days

b. Failure to timely:

i. Submit Tank Farm Closure Preliminary and Final Design Reports;

ii. Submit Lagoon Closure Preliminary and Final Design Reports;

iii. Complete Installation of Water Treatment System;

iv. Complete Tank Farm Closure;

v. Complete Surface Lagoon Closure;

vi. Complete Installation of Groundwater Monitoring System;

vii. Submit Final Report.

c. The following stipulated penalties shall be payable per violation per day to U.S. EPA for failure to submit timely or adequate reports, provide notice, or secure access pursuant to the Work Plan or this Consent Order:

<u>Penalty Per Violation Per Day</u>	<u>Period of Noncompliance</u>
\$250	Up to 30 Days
\$500	31 to 60 Days
\$1000	Over 60 Days

d. All stipulated penalties shall begin to accrue on the day after the complete performance is due or the day a violation occurs, and shall continue to accrue through the final day of the correction of the noncompliance or completion of the activity. Nothing herein shall prevent the simultaneous accrual of separate penalties for separate violations of this Consent Order.

32. All penalties which accrue pursuant to the requirements of this Consent Order shall be paid within thirty (30) days of written demand by U.S. EPA. Payment shall be made to the U.S. EPA Hazardous Substances Superfund delivered to the U.S. EPA, Attn: Superfund Accounting, P.O. Box 70753, Chicago, Illinois 60673, in the form of a certified or cashier's check payable to "U.S. EPA Hazardous Substances Superfund." The face of the check should note that the payment is for the Commercial Oil Services Site.

33. a. Pursuant to 31 U.S.C. Section 3717, interest shall accrue on any amount of overdue stipulated penalties at a rate established by the United States Treasury. Stipulated penalties shall accrue, but need not be paid, during any dispute resolution period concerning the particular penalties at issue. If Respondents prevail upon resolution, Respondents shall pay only such penalties as the resolution requires.

b. Notwithstanding the above provisions, Respondents shall have the right to petition U.S. EPA for a reduction or waiver of stipulated penalties that accrue during dispute resolution for items upon which they did not prevail. Such petition shall be based on evidence (1) that the delay in work or other violation that caused the stipulated penalty to accrue was necessary and appropriate during the dispute resolution proceeding; (2) that Respondents' position regarding the dispute had substantial support in law and fact and reasonably could have been expected to prevail, considering the applicable standard of review; and (3) that Respondents sought dispute resolution expeditiously and took all other appropriate steps to avoid any delay in remedial action work as a result of the dispute. U.S. EPA may grant as it deems appropriate, in its sole and unreviewable discretion, a reduction or waiver in the stipulated penalties that accrued during the dispute resolution period. Any determination under this paragraph is not subject to dispute resolution or otherwise subject to judicial review. Respondents shall have the burdens of proof and persuasion on any petition submitted to U.S. EPA under this paragraph. Until receipt of written notification from U.S. EPA stating the disposition of Respondents' petition, Respondents shall place any stipulated penalties as they accrue (at least every 60 days) in an interest bearing account. The total amount of these funds that is not reduced or waived by U.S. EPA under this subparagraph shall be due and payable to U.S. EPA within 15 days after written notice that such amount is due and payable.

34. Payment of Stipulated Penalties will not relieve Respondents from complying with the terms of this Consent Order. U.S. EPA retains the right to seek any remedies or sanctions available to U.S. EPA by reason of Respondents' noncompliance with the provisions of this Consent Order that are not otherwise expressly limited by these Stipulated Penalty provisions.

PENALTIES FOR NONCOMPLIANCE

35. Respondents are advised pursuant to Section 106(b) of CERCLA, 42 U.S.C. Section 9606(b), that violation or subsequent failure or refusal to comply with this Consent Order or any Work Plan approved under this Consent Order, or any portion thereof, may subject the Respondents, Capped De Minimis Respondents, and /or De Minimis Respondents to a civil penalty of no more than \$25,000 per day for each day in which such violation occurs, or such failure to comply continues. In addition, failure to properly provide removal action upon the terms of this order, or other subsequent orders issued by U.S. EPA, may result in liability for punitive damages pursuant to Section 107(c)(3) of CERCLA, 42 U.S.C Section 9607(c)(3).

TERMINATION AND SATISFACTION

36. The Respondents shall submit a final report summarizing the actions taken to comply with this Consent Order. The report shall contain, at a minimum: identification of the site, a description of the locations and types of hazardous substances encountered at the facility upon the initiation of work performed under this Consent Order, a chronology and description of the actions performed (including both the organization and implementation of response activities), a listing of the resources committed to perform the work under this Consent Order (including financial, personnel, mechanical and technological resources), identification of all items that affected the actions performed under the Consent Order and discussion of how all problems were resolved, a listing of quantities and types of materials removed, a discussion of removal and disposal options considered for those materials, a listing of the ultimate destination of those materials, and a presentation of the analytical results of all sampling and analyses performed and accompanying appendices containing all relevant paperwork accrued during the action (e.g., manifests, invoices, bills, contracts, permits). The final report shall also include an affidavit from a person who supervised or directed the preparation of that report. The affidavit shall certify under penalty of law that based on personal knowledge and appropriate inquiries of all other persons involved in preparation of the report, the information submitted is true, accurate and complete to the best of the affiant's knowledge and belief. The report shall be submitted within 60 calendar days of completion of the work required by the U.S. EPA.

37. The provisions of this Consent Order shall be deemed satisfied upon payment by Respondents of all sums due under the terms of this Consent Order and upon the Respondent's receipt of written notice from U.S. EPA that the Respondents have demonstrated, to the satisfaction of U.S. EPA, that all of the terms of this Consent Order, including any additional tasks consistent with this Consent Order which U.S. EPA has determined to be necessary, have been completed.

INDEMNIFICATION

38. The Respondents agree to indemnify and save and hold harmless the United States Government, its agencies, departments, agents, and employees, from any and all claims or causes of action arising from, or on account of, acts or omissions of the Respondents, its officers, employees, receivers, trustees, agents, successors or assigns, in carrying out the activities pursuant to this Consent Order. Respondents, by this agreement, do not assume any liability arising from the acts or omissions of U.S. EPA or its agencies, departments, agents and employees during the course of any activities conducted pursuant to this Consent Order. The United States Government shall not be held as a party to any contract entered into by the Respondents in carrying out activities under this Consent Order.

FORCE MAJEURE

39. The Respondents shall cause all work to be performed within the time limits set forth herein and in the approved Work Plan, unless performance is delayed by "force majeure". For purposes of this Consent Order, "force majeure" shall mean an event arising from causes beyond the control of the Respondents or of any entity controlled by Respondents, including, but not limited to, their contractors and subcontractors, that delays or prevents the performance of any obligation under this Consent Order despite Respondents' best effort to fulfill the obligation. The requirement that the Respondents exercise "best efforts to fulfill the obligation" includes using best efforts to anticipate any potential force majeure event and best efforts to address the effects of any potential force majeure event 1) as it is occurring and 2) following the potential force majeure event, such that the delay is minimized to the greatest extent possible. "Force Majeure" does not include financial inability to complete the Work or a failure to attain the Performance Standards.

40. If any event occurs or has occurred that may delay the performance of any obligation under this Consent Order, whether or not caused by a force majeure event, the Respondents shall notify orally the OSC within 48 hours of when Respondents first knew or should have known that the event might cause a delay. Within 5 days thereafter, Respondents shall provide in writing to U.S. EPA an explanation and description of the reasons for the

delay; the anticipated duration of the delay; all actions taken or to be taken to prevent or minimize the delay; a schedule for implementation of any measures to be taken to prevent or mitigate the delay or the effect of the delay; the Respondents rationale for attributing such delay to a force majeure event if they intend to assert such a claim; and a statement as to whether, in the opinion of the Respondents, such event may cause or contribute to an endangerment to public health, welfare or the environment. The Respondents shall include with any notice all available documentation supporting their claim that the delay was attributable to a force majeure. Failure to comply with the above requirements shall preclude Respondents from asserting any claim of force majeure for that event. Respondents shall be deemed to have notice of any circumstance of which their contractors or subcontractors had or should have had notice. If EPA agrees that the delay or anticipated delay is attributable to a force majeure, the time for performance of the obligations under this Consent Order that are affected by the force majeure event will be extended by U.S. EPA for such time as is necessary to complete those obligations. An extension of the time for performance of the obligations affected by the force majeure event shall not, of itself, extend the time for performance of any other obligation. If EPA does not agree that the delay or anticipated delay has been or will be caused by a force majeure event, U.S. EPA will notify the Respondents in writing to its decision. If U.S. EPA agrees that the delay is attributable to a force majeure event, U.S. EPA will notify the Respondents in writing of the length of the extension, if any, for performance of the obligations affected by the force majeure event. If the Respondents elect to invoke the dispute resolution procedures, they shall do so no later than 15 days after receipt of U.S. EPA's notice.

NON-ADMISSION

41. The consent of the Respondents, Capped De Minimis Respondents, De Minimis Respondents and Federal Agency Respondents to the terms of this Consent Order shall not constitute or be construed as an admission of liability or of U.S. EPA's findings or determinations contained in this Consent Order in any proceeding other than a proceeding to enforce the terms of this Consent Order.

COVENANTS BY RESPONDENTS AND DE MINIMIS RESPONDENTS

42. The Respondents, Capped De Minimis Respondents, and De Minimis Respondents covenant not to sue and agree not to assert any claims or causes of action against the U.S. EPA for any activity or obligation performed or expenses incurred pursuant to this Consent Order, including, but not limited to, any direct or indirect claim for reimbursement from the Hazardous Substance Superfund (established pursuant to the Internal Revenue Code, 26

U.S.C. Section 9507) through CERCLA Sections 106(b)(2), 111, 112, 113 or any other provision of law; or any claim against the United States, including any department; agency or instrumentality of the United States, under CERCLA Sections 107 or 113 for any activity or obligation performed or expenses incurred pursuant to this Consent Order or any claims arising out of response activities at the Site. However, the Respondents reserve, and this Consent Order is without prejudice to: 1) actions against Federal Agency Respondents under CERCLA Sections 107 or 113 for non-performance under this Consent Order; 2) actions against the U.S. EPA based on negligent actions taken directly by the U.S. EPA (not including oversight or approval of the Respondents plans or activities) that are brought pursuant to any statute other than CERCLA and for which the waiver of sovereign immunity is found in a statute other than CERCLA. Nothing in this Consent Order shall be deemed to constitute preauthorization of a claim within the meaning of Section 111 of CERCLA, 42 U.S.C. Section 9611, or 40 C.F.R. Section 300.700(d).

U.S. EPA COVENANT NOT TO SUE - RESPONDENTS

43. Upon termination and satisfaction of this Consent Order pursuant to its terms, for and in consideration of the complete and timely performance by Respondents of the obligations agreed to in this Consent Order, U.S. EPA hereby covenants not to sue Respondents, or their officers, directors, employees, successors and assigns, for judicial imposition of damages or civil penalties for any failure to perform obligations agreed to in this Consent Order except as otherwise reserved herein.

44. Performance of the terms of this Consent Order resolves and satisfies the liability of the Respondents to U.S. EPA for work satisfactorily performed under this Consent Order.

45. In consideration of the actions that will be performed and the payments that will be made by the Respondents under the terms of the Consent Order, the U.S. EPA covenants not to sue or to take administrative action against the Respondents, or their officers, directors, employees, successors and assigns, pursuant to Sections 106 and 107(a) of CERCLA, 42 U.S.C. Sections 9606, 9607(a), and Section 7003 of RCRA, 42 U.S.C. Section 6973, for performance of the Work and for recovery of Past Response Costs and Oversight Response Costs. These covenants not to sue shall take effect upon the receipt by EPA of the payments required by Paragraph 24. These covenants not to sue are conditioned upon the complete and satisfactory performance by Respondents of their obligations under this Consent Order.

DE MINIMIS CERTIFICATION

46. Each Capped De Minimis Respondent, De Minimis Respondent and Federal Agency Respondent certifies that, to the best of its

knowledge and belief, the information currently in U.S. EPA's possession accurately reflects each Capped De Minimis Respondent, De Minimis Respondent and Federal Agency Respondent's best information about the kind and quantity of hazardous substances delivered by it to the Site or to another for transport to the Site. If this certification is subsequently determined to be fraudulent, each Capped De Minimis Respondent, De Minimis Respondent and Federal Agency Respondent shall forfeit all payments made pursuant to Paragraphs 19 or 20 of this Consent Order. Such forfeiture shall not constitute liquidated damages and shall not in any way foreclose U.S. EPA's right to pursue any other causes of action arising from any Capped De Minimis Respondent or De Minimis Respondent's false certification.

COVENANT NOT TO SUE - CAPPED DE MINIMIS RESPONDENTS

47. Subject to the reservations of rights in Paragraphs 50, 51, 52, 53, 54, 55, 56, and 57 of this Consent Order, and the certification requirements of Paragraph 46 of this Consent Order, U.S. EPA and Respondents covenant not to sue or to take any other civil judicial or administrative action against any Capped De Minimis Respondent, or its officers, directors, employees, successors and assigns, for any and all civil liability to U.S. EPA and Respondents for causes of action arising under Sections 106 and 107(a) of CERCLA, 42 U.S.C. Sections 9606, 9607(a), and Section 7003 of RCRA, 42 U.S.C. Section 6973, relating to Past Response Costs, Oversight Response Costs, performance of the Work under this Order and treatment of surface lagoon sludge at the Site. This covenant not to sue shall take effect as to each Capped De Minimis Respondent listed in Appendix B after that Capped De Minimis Respondent has made timely and full payment pursuant to Paragraph 19 of this Consent Order. Nothing in this Consent Order is intended to be nor shall it be construed as a release or covenant not to sue for any claim or cause of action, administrative or judicial, civil or criminal, past or future, at law or in equity, which U.S. EPA may have against any or all of the Capped De Minimis Respondents for Oversight Response Costs, injunctive relief, or damages that are incurred by EPA, or which the Respondents may have against any or all of the Capped De Minimis Respondents for response costs incurred by Respondents under this Consent Order, or the aggregated claims or causes of action of U.S. EPA and the Respondents arising under this Consent Order against any or all of the Capped De Minimis Respondents, which are in excess of \$36 million.

COVENANT NOT TO SUE - DE MINIMIS RESPONDENTS

48. Subject to Paragraphs 50, 51, 52, 53, 54, 55, 56, and 57 of this Consent Order, and the certification requirements of Paragraph 46 of this Consent Order, U.S. EPA, Respondents and Capped De Minimis Respondents covenant not to sue or to take any other civil judicial or administrative action against any De

Minimis Respondent or Federal Agency Respondent, or its officers, directors, employees, successors and assigns, for any and all civil liability to U.S. EPA and Respondents for causes of action arising under Sections 106 and 107(a) of CERCLA, 42 U.S.C. Sections 9606, 9607(a), and Section 7003 of RCRA, 42 U.S.C. Section 6973 relating to Past Response Costs, Oversight Response Costs, performance of the Work under this Order and treatment of the surface lagoon sludge at the Site. This covenant not to sue shall take effect as to each De Minimis Respondent listed in Appendix C and each Federal Agency Respondent listed in Appendix D after each has made timely and full payment pursuant to Paragraph 19 or 20 of this Consent Order.

RESERVATION OF RIGHTS

49. The covenants not to sue set forth above do not pertain to any matters other than those expressly specified in paragraphs - 42, 43, 44, 45, 47 and 48.

50. Notwithstanding any other provision of this Consent Order, the U.S. EPA reserves, and this Consent Order is without prejudice to, all rights against Respondents, Capped De Minimis Respondents, and De Minimis Respondents with respect to all other matters, including but not limited to, the following:

- a) claims based on a failure to meet a requirement of this Consent Order;
- b) liability arising from the past, present, or future disposal, release, or threat of release of hazardous substances outside of the Site;
- c) liability for damages for injury to, destruction of, or loss of natural resources;
- d) liability for response costs that have been or may be incurred by federal natural resources trustees;
- e) criminal liability;
- f) liability for violations of federal or state law which occur during or after implementation of the Removal Action;
- g) liability for future response action at the Site.

51. In the event U.S. EPA determines that Respondents have failed to implement any provisions of the Work in an adequate or timely manner, U.S. EPA may perform any and all portions of the Work as U.S. EPA determines necessary. Costs incurred by U.S. EPA in performing the Work pursuant to this Paragraph shall be considered Oversight Response Costs that Respondents shall pay pursuant to Paragraph 23.

52. Nothing herein is intended to release, discharge, limit or in any way affect any claim, causes of action or demands in law or equity which the parties may have against any persons, firm, trust, joint venture, partnership, corporation, or other entity not a party to this Consent Order for any liability it may have

arising out of, or relating in any way to, the generation, storage, treatment, handling, transportation, disposal, release or threat of release of any hazardous substance, hazardous waste, contaminant or pollutant at or from the site. The parties to this Consent Order hereby expressly reserve all rights, claims, demands and causes of action they may have against any and all other persons and entities who are not parties to this Consent Order.

53. Nothing herein shall be construed: 1) to prevent U.S. EPA from exercising its right to disapprove of work performed by the Respondents; 2) to prevent U.S. EPA from seeking legal or equitable relief to enforce the terms of this order; 3) to prevent U.S. EPA from taking other legal or equitable action not inconsistent with the Covenant Not To Sue in Paragraphs 43, 44, 45, 47 and 48 of this Consent Order; 4) to prevent U.S. EPA from requiring the Respondents, Capped De Minimis Respondents, and/or De Minimis Respondents in the future to perform additional activities pursuant to CERCLA, 42 U.S.C. Section 9601 et seq., or any other applicable law; 5) to prevent U.S. EPA from undertaking response actions at the Site; and 6) to permit pre-enforcement review of the remedy selected in the Action Memorandum for this Site.

54. If any provision of this Consent Order is deemed invalid or unenforceable, the remainder of this Consent Order shall remain in full force and effect.

55. This Consent Order is not intended for the benefit of any person not a signatory to this Consent Order and may not be enforced by any person not a signatory to this Consent Order.

56. The covenants not to sue in Paragraphs 47 and 48 of this Consent Order are null and void, if information not currently known to U.S. EPA is discovered which indicates that any Capped De Minimis Respondent, or De Minimis Respondent contributed hazardous substances to the Site in such greater amount or of such greater toxic or other hazardous effects that the Capped De Minimis Respondent, or De Minimis Respondent no longer qualifies as a De Minimis party at the Site because the respondent contributed greater than 1.0% of the hazardous substances at the Site or contributed hazardous substances which contributed disproportionately to the cumulative toxic or other hazardous effects of the hazardous substances at the Site.

57. Notwithstanding any other provision of this Consent Order, the U.S. EPA reserves, and this Consent Order is without prejudice to, all rights against Capped De Minimis Respondents and De Minimis Respondents with respect to all other matters, including but not limited to, failure to make timely payments as required by this Consent Order.

CONTRIBUTION PROTECTION

58. With regard to claims for contribution against Respondents, Capped De Minimis Respondents, De Minimis Respondents and Federal Agency Respondents, for matters addressed in this Consent Order, the Parties hereto agree that the Respondents, Capped De Minimis Respondents, De Minimis Respondents and Federal Agency Respondents, are entitled, as of the effective date of this Consent Order, to such protection from contribution actions or claims as is provided in CERCLA Sections 113(f)(2) and 122(g)(5).

SUBSEQUENT AMENDMENT

59. This Consent Order may be amended by mutual agreement of U.S. EPA and the Respondents. Any amendment of this Consent Order shall be in writing, signed by U.S. EPA and the Respondents and shall have as the effective date the date upon which U.S. EPA issues written notice to the Respondent(s).

ATTORNEY GENERAL APPROVAL

60. The Attorney General or her designee has issued prior written approval of the settlement embodied in this Consent Order in accordance with Sections 122(g)(4) and 122(h) of CERCLA.

EFFECTIVE DATE

61. The effective date of this Consent Order shall be the date upon which U.S. EPA issues written notice to the Respondents that the public comment period pursuant to Paragraph 22 of this Consent Order has closed and that comments received, if any, do not require modification of or U.S. EPA withdrawal from this Consent Order.

The above being agreed and consented to, it is so ORDERED

this _____ day of _____, 199_.

By _____
Valdas V. Adamkus
Regional Administrator
U.S. Environmental Protection Agency
Region V, Complainant

COMMERCIAL OIL SERVICES
ADMINISTRATIVE ORDER ON CONSENT

The undersigned Party to this Administrative Order on Consent has reviewed and hereby consents to the foregoing Administrative Order on Consent, In the Matter of Commercial Oil Services, and agrees to be bound by its terms and conditions and that he or she is fully authorized to enter into the terms and conditions of this Administrative Order on Consent and to bind such signatory, its successors and assigns, to this document.

FIRM

DATE

BY: _____

Signature

Title

The above Party to this Administrative Order on Consent has checked off below which of the three available settlement options it has selected:

Settlement Option I -
Respondent _____

Settlement Option II -
Capped De Minimis Respondent _____

Settlement Option III -
De Minimis Respondent or
Federal Agency Respondent _____

APPENDIX A
RESPONDENTS

APPENDIX B

CAPPED DE MINIMIS RESPONDENTS

APPENDIX C
"DE MINIMIS RESPONDENTS"

APPENDIX D
FEDERAL AGENCY RESPONDENTS

APPENDIX E

PHASE II
REMOVAL ACTION WORK PLAN FOR
TANK FARM AND
LAGOON CLOSURE

COMMERCIAL OIL SERVICES SITE
OREGON, OHIO

MAY 14, 1993
(REVISION 4)

Prepared for:

Commercial Oil Services Site PRP Group

Prepared by:

McLaren/Hart Engineers Midwest, Inc.
300 Stevens Drive, Suite 200
Lester, PA 19113



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REMOVAL ACTION WORK PLAN FOR
TANK FARM AND
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1.0 INTRODUCTION AND OVERVIEW

1.1 PURPOSE AND OBJECTIVES

This Removal Action Work Plan (RAWP) has been prepared and submitted by McLaren/Hart on behalf of the Commercial Oil Services Site Steering Committee pursuant to Administrative Order on Consent (Docket No. VW88-C-116) issued by the United States Environmental Protection Agency (EPA) on June 30, 1988. In addition, this RAWP specifies work to be performed pursuant to the Phase II Administrative Order on Consent (AOC). The Phase II AOC requires the Respondents to the Phase II AOC to undertake and complete removal activities to abate conditions at the Commercial Oil Services Site which may present an imminent and substantial endangerment to public health, welfare or the environment. This RAWP has been prepared in conformance with the Action Memorandum dated November 12, 1992 for the Commercial Oil Services Site in Oregon, Ohio, issued by EPA pursuant to the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). The RAWP has been prepared in accordance with the EPA document entitled, "Superfund Remedial Design and Removal Action Guidance" (OSWER Directive 9355.0-4A, June 1986) to the extent appropriate and in a manner consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

The RAWP describes the work to be performed under the Action Memorandum dated November 12, 1992. As described in greater detail throughout the RAWP, the work to be performed under the Action Memorandum includes the following basic elements:

- Closure of the tank farm, surface lagoons and other Site areas exclusive of the cell; and
- Construction of an engineered cell within the lagoon area including liner, cap, and operation and maintenance of the cell, and placement of solidified/stabilized sludge and other residuals into the engineered cell; and

- Post-closure monitoring requirements.

The objective of this RAWP is to set forth general procedures, methods, and schedules for completing the Removal Action at the Commercial Oil Services Site. As set forth in the Phase II AOC, the Respondents to the Phase II AOC shall implement all removal activities set forth in this RAWP which includes submission of Removal Action Design Reports, construction of the Removal Action, and operation and maintenance of the Removal Action.

1.2 SITE DESCRIPTION AND HISTORY

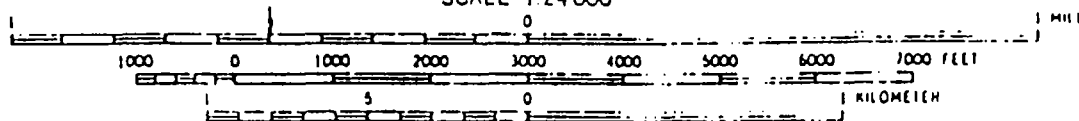
1.2.1 Description

The Commercial Oil Services Site is located at the intersection of Otter Creek Road and Cedar Point Road in an industrial section of Oregon, Ohio. The Site lies approximately one mile south of Maumee Bay and about one mile south-southwest of the Maumee River. The Site is bounded on the north by Cedar Point Road and an oil refinery, on the west by Otter Creek Road, on the south by a closed solid waste landfill and an operating RCRA permitted hazardous waste landfill, and on the east by an industrial gases plant. The street address of the Site is 3600 Cedar Point Road, Oregon, Ohio. The location of the Site is illustrated in Figure 1-1.

A portion of the Site, occupying approximately five acres in the northeast corner of the 20 acre parcel, contains seven surface impoundments; major features of the Site are illustrated in Figure 1-2. Additionally, an office/warehouse building and a tank farm are present in this portion of the property. Four underground tanks including a septic system are located near the main building.



SCALE 1:24,000



MCLAREN/HART
ENGINEERS MIDWEST, INC.

SITE LOCATION MAP
COMMERCIAL OIL SERVICES SITE
OREGON, OHIO

DATE: 11-23-97

(drawing no.)

1.2.2 History

Commercial Oil Services, incorporated under the laws of the State of Ohio, was a family-owned business established in 1949 to collect waste oil for sale. The business was moved to its current location at 3600 Cedar Point Road when the real estate was purchased by the corporation in 1969. During its operational life, Commercial Oil Services collected, reclaimed and re-refined waste oils, waste sludges and solvents. According to the Part A RCRA permit application submitted by Commercial Oil Services, K049 (slop oil emulsion solids from the petroleum refining industry) and K051 (API separator sludge from the petroleum refining industry) wastes were to be managed on-site, and F002 (spent halogenated solvents), F003 and F005 (spent non-halogenated solvents), K049 and K051 waste were stored in tanks and containers. In a letter to the Ohio Environmental Protection Agency dated September 21, 1983, the President of Commercial Oil Services reported that the surface impoundments had not been used for the disposal and storage of hazardous waste. The lagoons were not used for the storage or disposal of listed hazardous wastes.

In 1985, Commercial Oil Services ceased operations at the Site and filed for bankruptcy. The Site, as it currently exists, consists of a 20 acre parcel. Upon termination of operations, approximately 1,200 waste drums containing various quantities of hazardous substances remained at the site with approximately 30,000 gallons of solvent material in approximately 20 large tanks. Seven surface impoundments (lagoons) comprising approximately five acres also existed at the Site. Four of the surface impoundments contained sludge contaminated with polychlorinated biphenyls (PCBs). Three of the surface impoundments had a surface oil layer which contained various concentrations of PCBs.

During the summer of 1986, the surface impoundments threatened to overflow due to heavy rains in the area. The United States Environmental Protection Agency conducted the following activities in responding to releases and threatened releases from the surface impoundments at the Site as part of its removal action: 1) transfer of water between impoundments to prevent off-site migration; 2) cleanup of PCB contaminated oil in soils; 3) treatment of surface impoundment

water and subsequent discharge to adjacent surface water; 4) initiation of an engineering evaluation/cost analysis at the Site.

Analytical results of the EPA's sludge sampling efforts showed Lagoons Nos. 1, 2, 6 and 7 to contain PCBs at levels ranging from 30 to 160 mg/kg. Other hazardous substances were also detected in the sludge of the lagoons.

In March of 1988, the EPA notified certain former customers of Commercial Oil Services of their status as potentially responsible parties (PRPs) for response actions to be taken by EPA at the Site. EPA and 43 of the PRPs (Respondents) negotiated and entered into an Administrative Order on Consent to perform various response actions at the Site. The Order required the respondents to undertake all measures necessary to prevent overflow of the impoundments at the site and to maintain two feet of freeboard. In addition, the Order required the Respondents to implement a program for removal and management of surface drums. The drum removal management program was completed in February of 1989. Freeboard maintenance activities consisting of water transfer and water treatment have been conducted numerous times. On-site water treatment activities have been conducted by the Respondents three times, in 1988, 1989-1990 and 1991. In total, over 22 million gallons of water have been treated and discharged. The Order also required the Respondents to implement a sampling plan to define the vertical and horizontal extent of organic and inorganic contaminants in the surface impoundments, to submit an EE/CA summarizing data collected through the sampling plan and pre-existing data, and to identify removal responses options which may be implemented at the Site.

The EE/CA Report was submitted to EPA in April of 1990. On June 9, 1991, EPA published a Proposed Removal Action Plan (PRAP) for the Site and held a public meeting on June 25, 1991. Public comment was accepted on the PRAP until October 8, 1991, as well as after that date. Prior to issuing an Action Memorandum, EPA asked the Respondents by letter dated June 11, 1991, to conduct a treatability study to evaluate the effectiveness of the proposed remedy for the Site. The Treatability Study Work Plan was submitted July 2, 1991, and modified by letter dated October 8, 1991, after addressing EPA's comments received during a September 11, 1991 telephone conversation and from an October 7, 1991 letter. The Work Plan

was approved by EPA letter dated November 13, 1991. A revised Treatability Study report was submitted to EPA on May 8, 1992. During the period May through November, 1992, a variety of submittals (letters, reports, etc.) were submitted to EPA in support of the EE/CA and treatability study. On November 12, 1992, EPA issued an Action Memorandum for the Site outlining the selected removal action for the Commercial Oil Services Site. The Action Memorandum, and the associated EPA document entitled "Summary of Removal Action Selection and EE/CA Summary" detail EPA's selection process for in-vessel sludge solidification/stabilization with on-site disposal in an engineered cell along with tank farm closure for the Site.

By letter dated November 17, 1992, EPA requested the Respondents proceed with the development of a Phase II Work Plan, to implement the response action outlined in the Action Memorandum. In accordance with the Phase I Order and Phase I work Plan, the Respondents have prepared this Phase II Work Plan.

1.3 SUMMARY OF REMOVAL ACTION WORK PLAN

This removal action work plan generally describes the procedures necessary to complete Removal Action Design and Removal Action Construction at the Commercial Oil Services Site (Site). The purpose of this Work Plan is to fulfill the requirements outlined in the Administrative Order on Consent dated June 30, 1988 and in conformance with the November 12, 1992 Action Memorandum. The objective of this work plan is to set forth general procedures, methods, and schedules for completing Removal Design and Construction at the Site which the Respondents to the Phase II AOC shall undertake.

2.0 DETAILED DESCRIPTION OF REMOVAL ACTION

This section presents a detailed description of the removal action for the Commercial Oil Services (COS) Site. The discussion is divided into the major elements of the action, as follows:

- Site Control;
- Tank Farm Closure;
- Associated Structures and Debris;
- Lagoon Closure;
- Site Work; and
- Operations and Maintenance.

2.1 SITE CONTROL

The removal action will require internal Site control for two tasks, specifically tank farm decommissioning and lagoon closure.

Several Site control features are consistent throughout the response action, two contaminant reduction zones (CRZ) will be constructed on-site. One CRZ will be constructed at the gate located directly north of the tank farm area. This CRZ will be placed to allow passage of vehicles onto the Site without entering the lagoon portion of the Site. This will allow all vehicles to pass through the CRZ for decontamination prior to leaving the Site. The CRZ will contain a vehicle decontamination pad of a size suitable for decontamination of trucks.

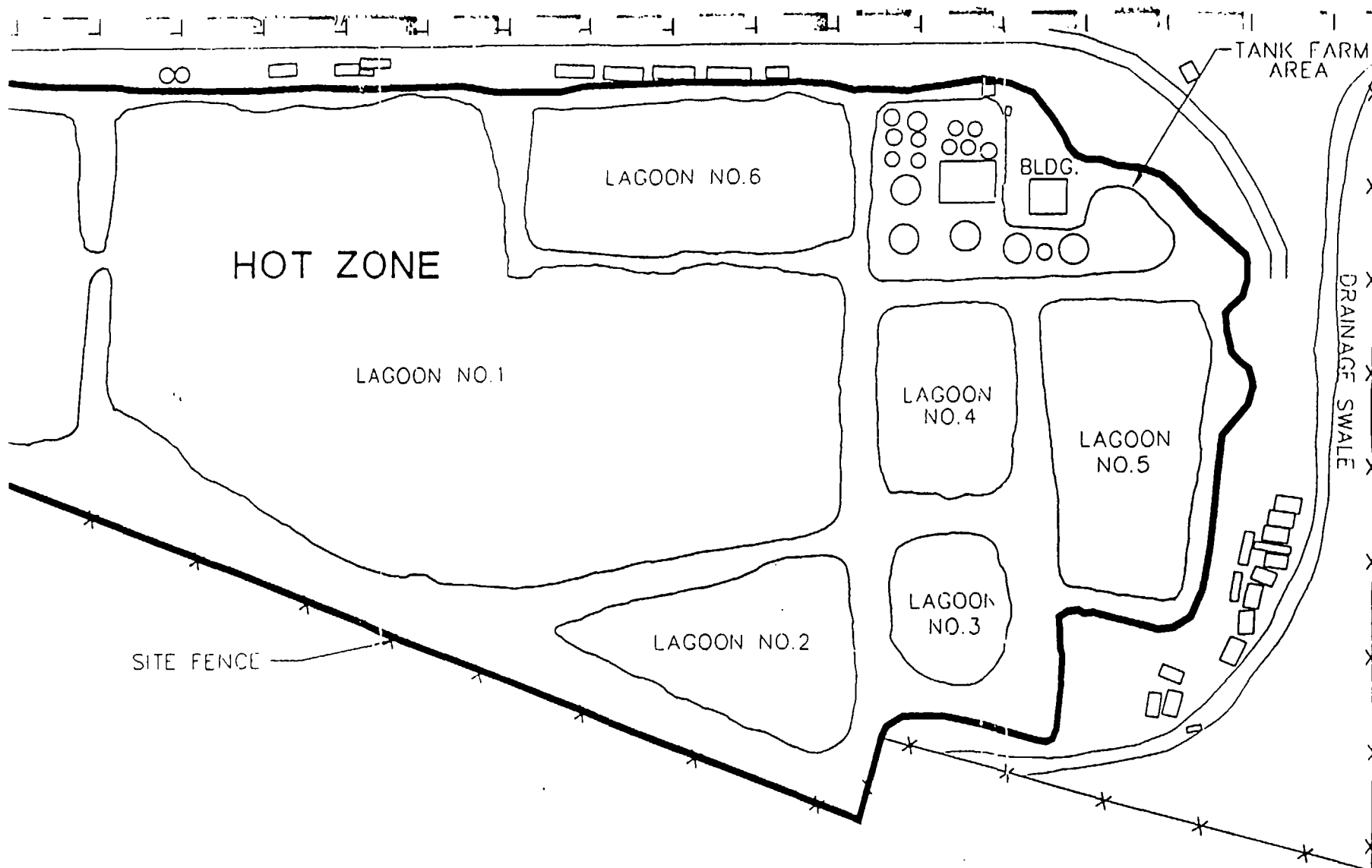
This gate and CRZ will serve as ingress/egress point for all vehicle access to the Site. Additionally, the CRZ will contain personnel dress out and personnel decontamination facilities to facilitate personnel entry and exit to the Site in cases where it is inconvenient or impossible to use the personnel CRZ.

The personnel CRZ will be located directly south of the garage located in the northwestern corner of the Site. This CRZ will be used for personnel entry and exit to the Site. It will

contain a personnel decontamination line capable of handling the number of workers on site in any phase of the removal action. The decontamination line will most likely contain trailers with showers and lockers. This CRZ will also contain a decontamination pad large enough to decontaminate trucks. However, it is anticipated that vehicle decontamination will only occur as a result of an emergency situation or when Site activities otherwise dictate.

During the tank farm decommissioning, which will also include the staging and removal of above and below ground tanks and Site debris, the hot zone (exclusion zone) will be defined as illustrated in Figure 2-1. The hot zone is the area in which there is the greatest potential for exposure to hazardous substances, thereby mandating the use of appropriate health and safety measures, personnel access restrictions, and personnel and equipment decontamination procedures. While the actual location of the hot zone will change depending on the actual operation on-going, the hot zone will, at times, include the garage (which will likely contain the water treatment system), the lagoons and the tank farm area. During the final stages of tank farm decommissioning, the former tank farm area will be graded and covered with a clean layer of 3/4" stone to allow it to be used as a support zone during the sludge solidification/stabilization (S/S) process operation.

Upon completion of the tank farm decommissioning and prior to startup of the lagoon closure stage, the hot zone will be redefined as illustrated in Figure 2-2. The hot zone will include the garage, all lagoons and the S/S Process Area tentatively located directly east of Lagoon No. 5. The hot zone will remain as shown in Figure 2-2 until completion of sludge S/S and placement in the engineered cell, at which time the hot zone will be eliminated. Both CRZs will be maintained until the Removal Action is complete. Once the removal action is complete, the personnel CRZ will be decontaminated, removed and all materials disposed of properly. The other decontamination pad, by the tank farm gate, will remain on-site, and be incorporated into the Site O&M program.

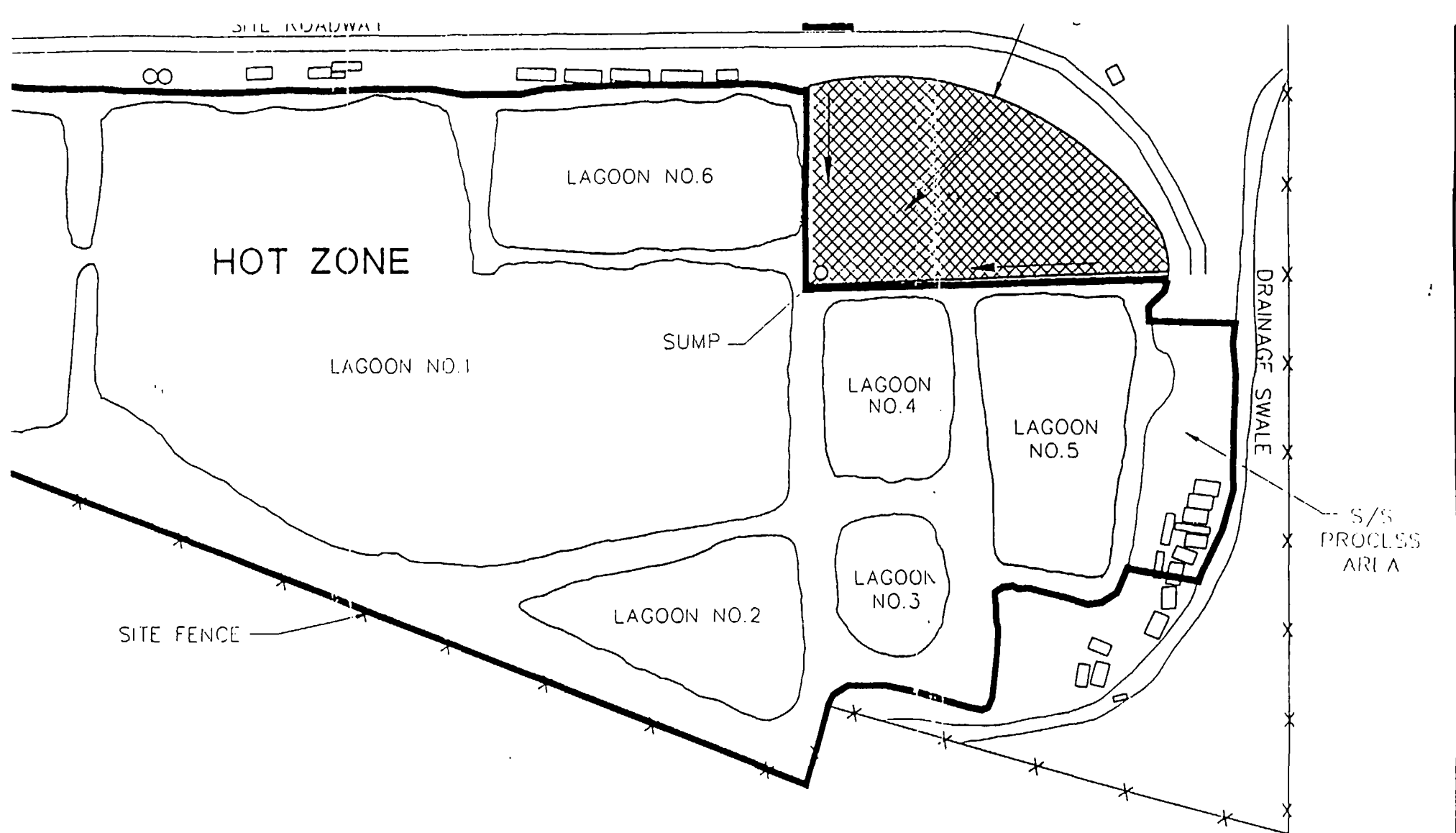


MCLAREN/HART
ENGINEERS MIDWEST, INC.

SITE CONTROL DURING
TANK FARM DECOMMISSIONING
COMMERCIAL OIL SERVICES SITE
OREGON, OHIO

DATE: 11-21-92
APP'D: K P

FIGURE 10.1



EXTENT OF 3/4 INCH STONE

SLOPE



MCLAREN/HART
ENGINEERS MIDWEST, INC.

SITE CONTROL DURING
S/S PROCESS OPERATION
COMMERCIAL OIL SERVICES SITE
OREGON, OHIO

DATE: 11-23-97
tpp'n

DRAWING NO.
F 12

2.1.1 Decontamination Pads

Two decontamination pads will be constructed as part of the Removal Action, their positioning was discussed in Section 2.1 titled "Site Control." The decontamination pad located at the tank farm gate is to serve as the primary truck decontamination facility, and will be constructed to serve as a permanent facility (i.e., for Removal Action O&M activities). This decontamination pad will feature, at a minimum; bermed containment area constructed of 6 inches of reinforced concrete, sump with submersible pump, and a pressure washer with optional soap injection or hot water capabilities.

The decontamination pad located near the garage in the northwestern corner of the Site will serve as a backup or emergency truck/vehicle decontamination pad throughout the Removal Action. This decontamination pad will feature, at a minimum; 20 mil PVC liner or equal, two layers of geotextile to protect the liner, 10 inches of 3/4" stone, sump with submersible pump, and pressure washer with optional soap injection or hot water capabilities. This decontamination pad will be maintained at an operational status throughout the construction phase of the Removal Action. The sumps of both decontamination pads will be capable of transferring decontamination water for treatment in the water treatment system.

2.1.2 Support Zone

The Support Zone will be located west and northwest of the garage building (see Figures 2-1 and 2-2). This area will house the following facilities, including, but not limited to:

- Office trailer(s);
- Lunch/break trailer(s);
- Equipment and PPE storage trailer(s);
- Site communication center (telephone, facsimile, photocopying, etc.);
- Weather station;
- Emergency command center; and
- Potable water and sanitary facilities.

A detailed description and layout of the facilities will be included in the final design submittal.

2.2 TANK FARM CLOSURE

The tanks located in the Tank Farm shall be closed in accordance with OAC 3745-66-97 (40 CFR 265.197). Major components of the cleaning and demolition are: tank contents; sampling and removal of possible asbestos containing insulation; tanks and piping; structures and foundations; and subsurface soils. Tank farm cleaning, demolition and preparation of the tank farm area as a support zone for the solidification/stabilization process is expected to take three months. A description of each component of the demolition is provided in the following sections.

2.2.1 Sampling and Removal of Asbestos Containing Insulation

Piping and tanks on-site are in some instances insulated, and as such, attention must be paid to potential asbestos risks. During the 1989 EE/CA investigation, five insulation samples were collected from the tank farm pipelines and were analyzed for asbestos content by polarized light microscopy (PLM) following EPA Method 600/M4-82-020. No asbestos was detected in any of the samples at a detection limit of 1%. The insulation was found to contain varying percentages of non-fibrous material, mineral wool, cellulose and other non-asbestos fiber. However, it is appropriate to determine that asbestos is not present. During the removal construction, prior to removal of tank contents, the contractor will undertake comprehensive asbestos sampling. Asbestos samples will be sent to an approved laboratory and analyzed using EPA Method 600/M4-82-020. Should the analytical results indicate the absence of asbestos, the removal construction will proceed to the removal of tank contents.

If the presence of asbestos is found, the contractor will undertake an asbestos abatement program in accordance with Site specific specifications. These procedures will be subject to EPA review and approval. The specifications will be developed during the Removal Action Design and will provide procedures for asbestos abatement.

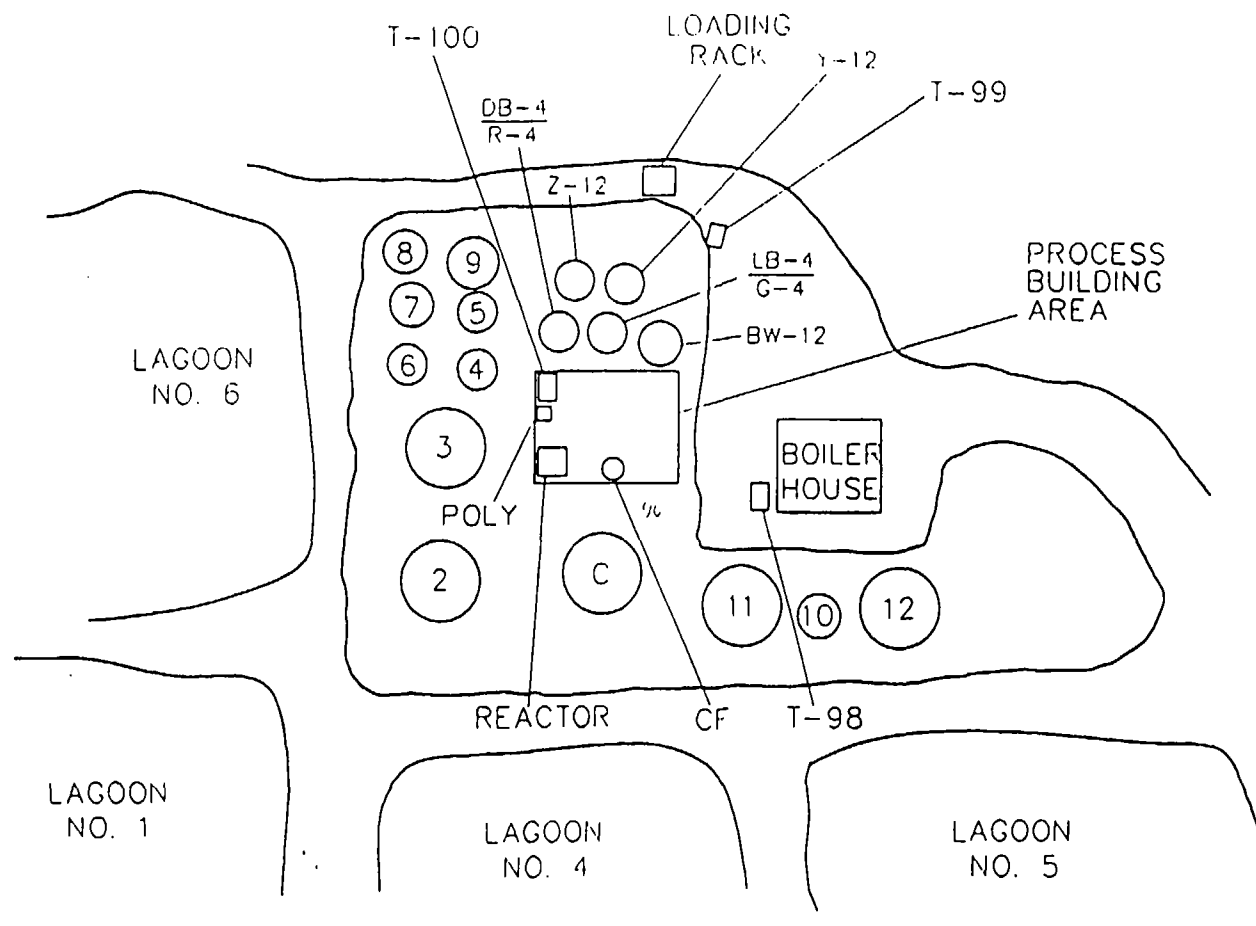
2.2.2 Tank Contents

The tank farm area contains 25 tanks, 24 of which were accessed during the 1989 EE/CA Investigation. Of the 24 tanks investigated, 10 were listed as empty. Tank number 3, which has an estimated volume of 42,750 gallons, was not investigated because of a lack of accessibility. The 14 tanks with measurable quantities of product and tank number 3 were estimated to contain a total of 85,800 gallons. Figure 2-3 shows a plan view of the tank farm area. Eight discrete samples were collected from the tanks containing product. Samples were collected from the following tanks; 2,4,5,6,7,12,C,99, analytical results can be found in Appendix A of the EE/CA.

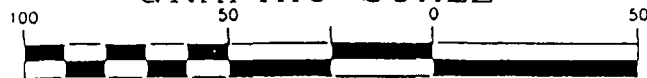
During the Removal Action, all tank contents will be field screened and bulked based on field screening results. Methods such as the following will be used to perform the field screening analysis of tank contents:

- Oxidizer Screening Analysis;
- pH Measurements;
- Water Mix Screening Analysis;
- Flammability Potential Screening Analysis;
- Prussian Blue Cyanide Screening Analysis;
- Cyantesmo Paper Cyanide Screening Analysis;
- Lead Acetate paper Sulfide Screening Analysis;
- Radioactivity Screening Analysis; and
- PCB Screening Analysis.

If discrete phases exist within a tank, each phase will be separately sampled and field screened prior to bulking. All resulting waste streams will be sampled and analyzed for RCRA characterization, PCBs and disposal parameters (e.g., heat value chlorine, sulfur, etc.). If any tank sample contains PCBs above 50 ppm, the tank contents will be disposed of off-site in accordance with TSCA regulations, DOT Rules for Transportation of Hazardous Materials and



GRAPHIC SCALE



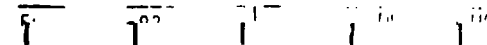
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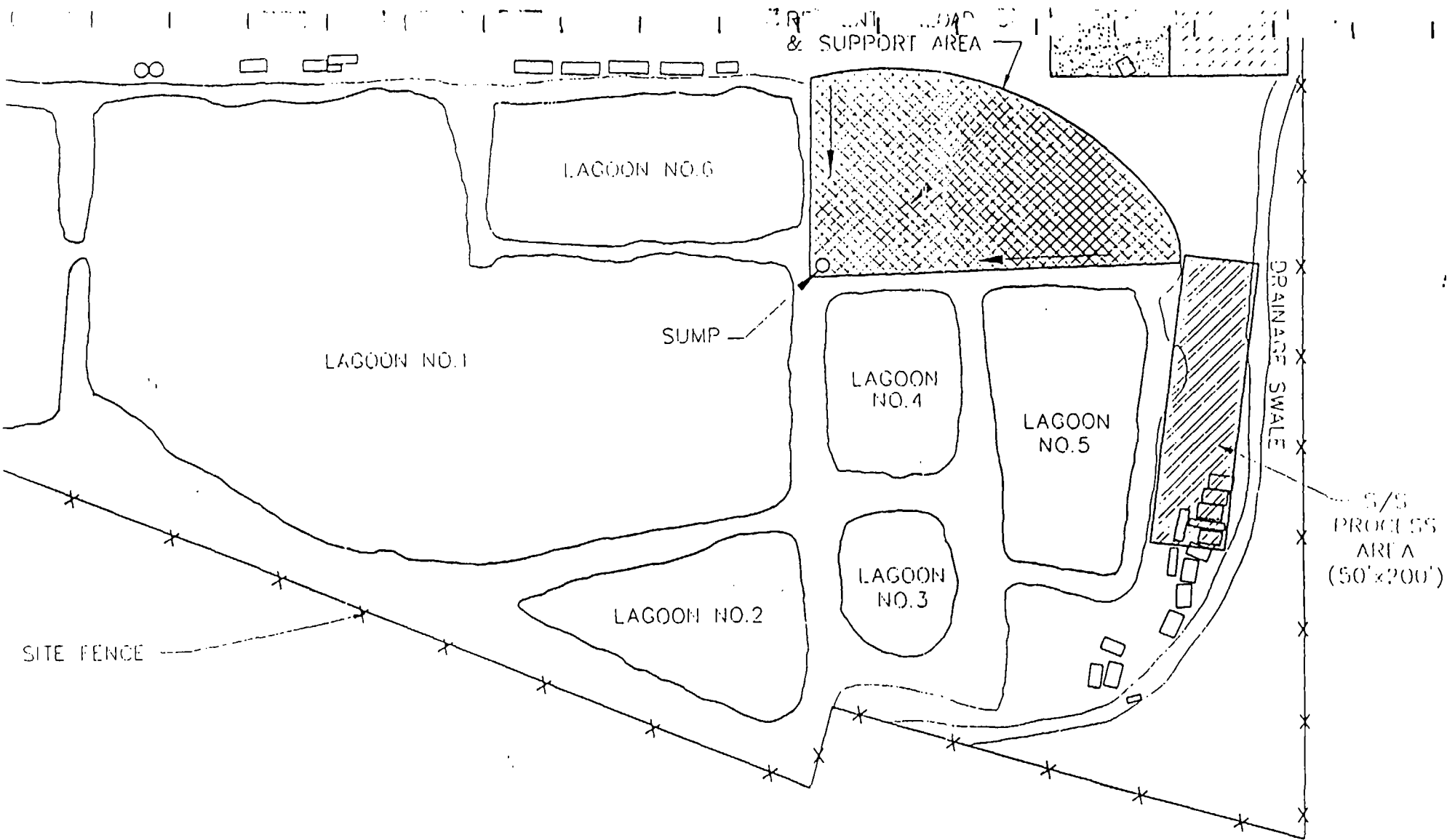
1 inch = 50 ft.



MCLAREN/HART
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TANK FARM PLANT VIEW
COMMERCIAL OIL SERVICES SITE
OREGON, OHIO





EXTENT OF 3/4 INCH STONE

SLOPE

CLEAN FILL STAGING AREA

RUBBLE STAGING AREA

S/S PROCESS AREA

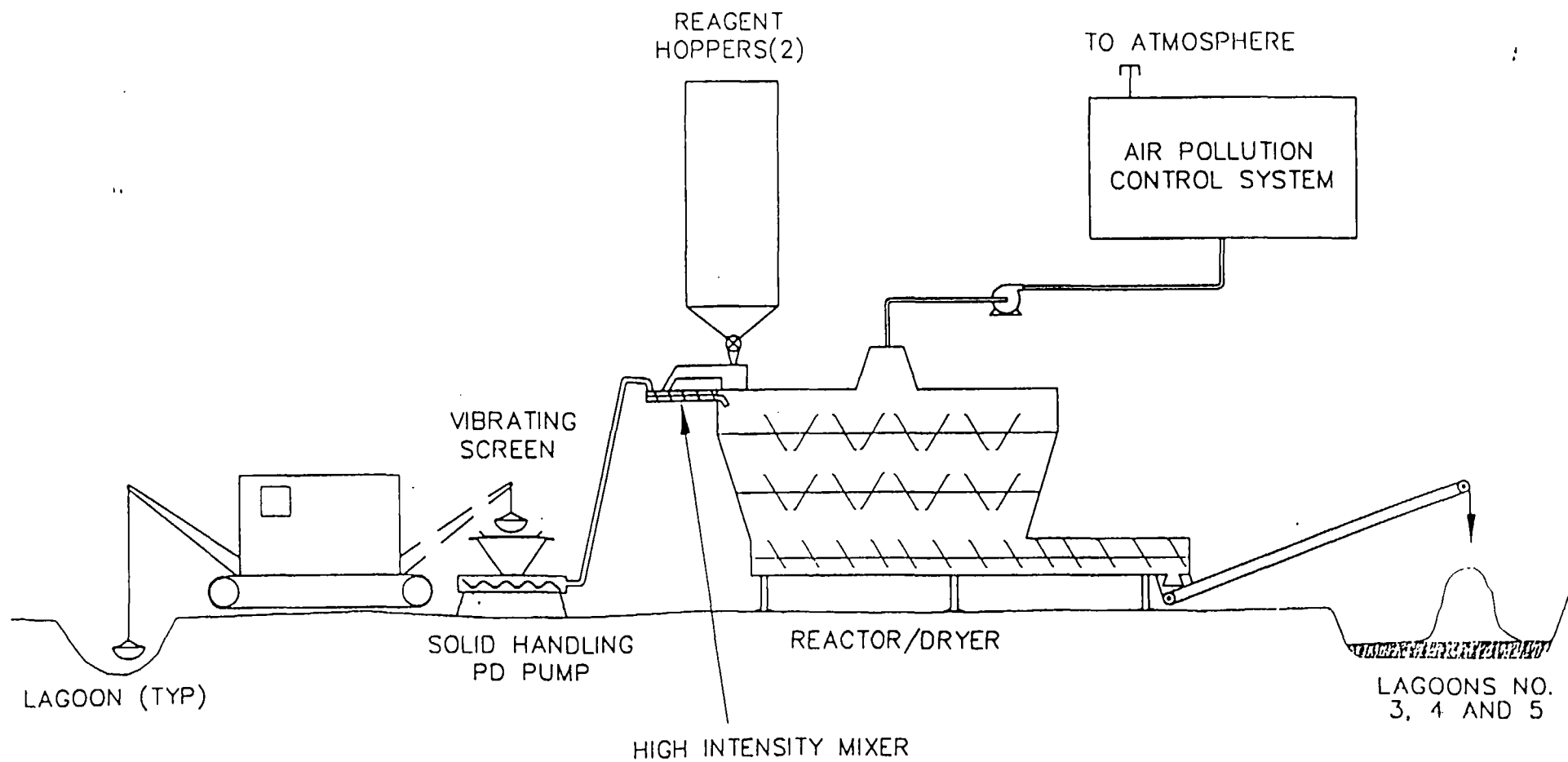


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ENGINEERS MIDWEST, INC.

PRELIMINARY LAYOUT
FOR S/S ACTIVITIES
COMMERCIAL OIL SERVICES SITE
OREGON, OHIO

DATE: 11-23-92
APP'D: V.D.

DRAWING NO.
FIGURE 9-1



MCLAREN/HART
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GENERIC PROCESS FLOW DIAGRAM
IN-VESSEL SLUDGE
STABILIZATION/SOLIDIFICATION
COMMERCIAL OIL SERVICES SITE
OREGON OHIO

EPA's off-site policy. Furthermore, tank contents with PCBs above 50 ppm shall not be utilized for fuel blending purposes.

Tank number 3 will be accessed and sampled as part of construction, and the contents of all 25 tanks will be handled in accordance with the following procedure.

- a. Each tank will be opened using non-sparking methods and tested for explosive limits.
- b. After testing a tank, a determination will be made as to whether the tank will require vapor control and what method will be used (i.e., venting or purging).
- c. The nature of the product will be determined by utilizing field screening methodologies.
- d. The pumpable product (material that can be removed using conventional pumps) will be removed, and placed in separate holding tanks depending on characteristics determined through field testing.
- e. Tanks will be purged/vented while monitoring the lower explosive limit (LEL) of the tank interior. Upon achieving a satisfactory LEL reading, a manway(s) will be cut in the side of the tank. Non-pumpable product (including sludge and solids) will be removed and containerized. Confined space entry will adhere to the guidelines established in the Removal Action Health and Safety Plan and API Publication 2217, "Guidelines for Confined Space Work in the Petroleum Industry."
- f. Once the sludges and solids have been removed, the tanks will be hot water pressure washed until determined to be clean (per API Publication 2015, "Cleaning Petroleum Storage Tanks") for hot work and suitable for nonhazardous scrap metal recycling.

- g. All rinsate will be either directly pumped to the treatment facility or containerized and either sent to the on-site treatment facility or sent off-site for treatment.
- h. The health and safety officer will certify the tanks as clean and safe for men and hot work in accordance with API Publication 2015, "Cleaning Petroleum Storage Tanks."

The product that has been removed from the tank farm will be sampled, and analyzed as necessary to supplement data gathered during the EE/CA to determine suitable disposal alternatives. During the EE/CA investigation, analytical results from the tank farm indicated that some of the materials had high heat value. Accordingly, the tank materials and possibly the tank sludges and solids are appropriate for fuel blending. Otherwise, sludges and solids will be managed at an appropriate off-site disposal facility. It is recognized that the Tank Farm historically managed F-listed hazardous waste. During removal activities, a determination will be made as to whether the tank contents and associated piping contents are F-listed (solvents) or waste "oil-like" in nature. If the tank contents are determined to be F-listed, the sludge contained in that tank will be characterized as F-listed waste. If the material is typical of impounded material from the site, it will be handled similarly to this impounded material. Further, if the tank contents are similar to the impounded material, any sludge or solids in the tank will be handled with lagoon sludge (S/S treated). Since F-listed wastes are not suitable for on-site disposal or use in the RCRA cap, all F-listed waste will be managed off-site.

2.2.3 Demolition of Tanks and Piping

Demolition of the tank farm superstructure will progress in a sequence designed to optimize efficiency and worker safety. Demolition of tanks will proceed as follows:

- Cutting of tanks into manageable pieces;
- Transport of large tank pieces, via crane to a laydown area;
- Fragmentation of tank pieces to facilitate loading and transport;
- Loading and transport of tank fragments to an acceptable salvaging facility.

Demolition of piping is anticipated to proceed as follows:

- Dismantle and rinse piping to remove gross product. Product in pipes will be collected and handled with associated tank contents;
- Transfer rinsate directly to the water treatment facility, or containerize and either send to the on-site treatment facility or send off-site for treatment;
- Transport of pipe segments to the laydown area;
- Pipe cutters will be used to remove fittings;
- A high pressure washer will be used to decontaminate the interior and exterior of all pipe; and
- Clean pipe will be staged outside of the laydown area.

Miscellaneous equipment in the tank farm area will be cleaned in accordance with the pipe cleaning protocol. Equipment that must be disassembled for proper decontamination will be done in the laydown area. To the extent practicable, all salvageable steel from the tanks, piping and equipment will be decontaminated and salvaged. All other material associated with the tanks, piping and equipment that is either inappropriate for salvage or cannot be satisfactorily decontaminated will be landfilled in the on-site cell or an appropriate off-site disposal facility.

The laydown area is a lined decontamination pad with sump, pump, rinsate holding tanks, and includes a wooden deck to protect the liner from puncture. The laydown area will likely be located to the east of tank BW-12. The laydown area sump will be capable of pumping water directly to the on-site treatment facility or to a container for appropriate on-site or off-site disposal. Specifications for the laydown area will be provided in the final design.

All activities associated with the Tank Farm decontamination will be conducted utilizing Best Management Practices (BMP) to minimize the release of, and generation of, F-listed wastes.

2.2.4 Demolition of Structures and Foundations

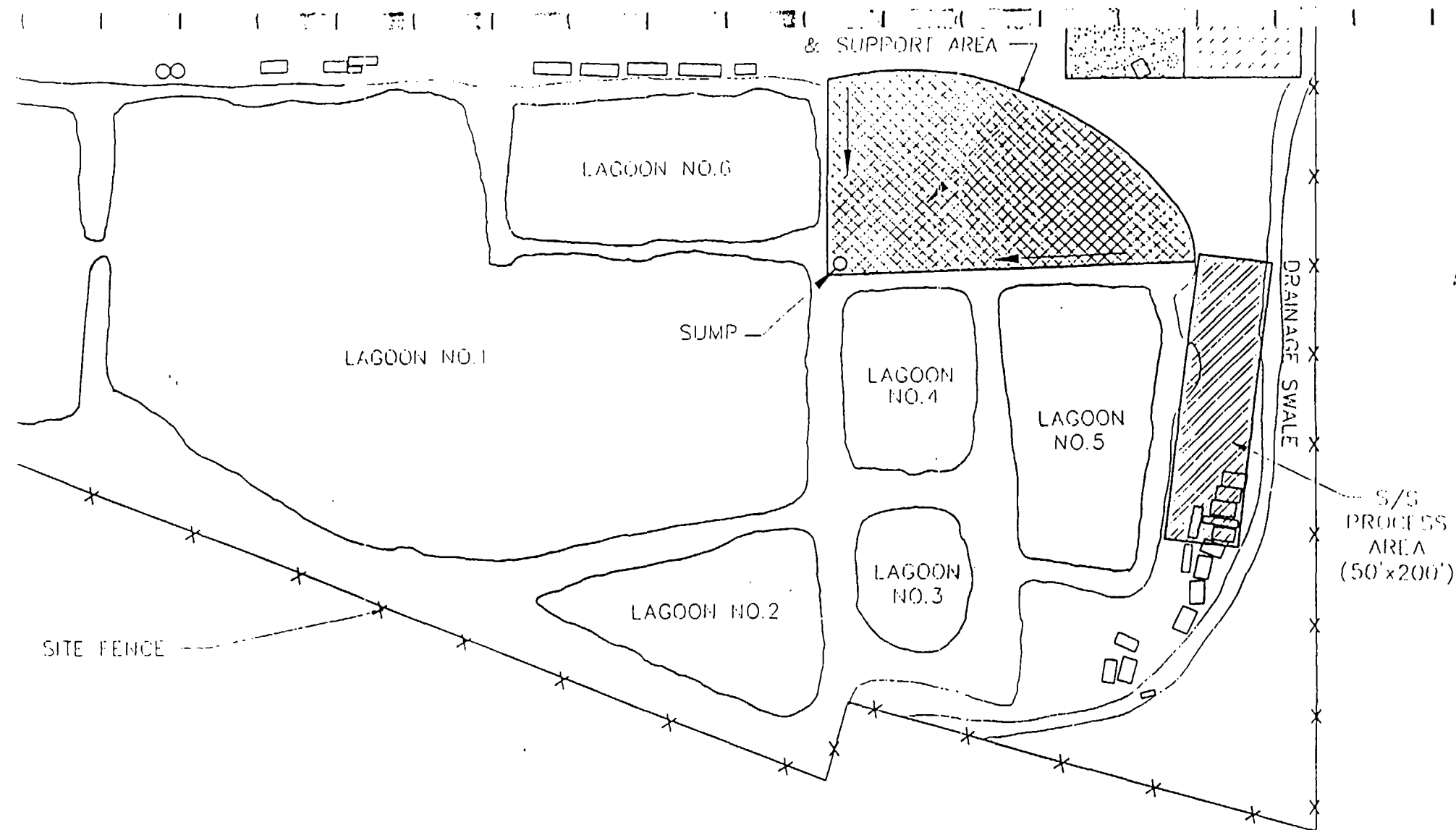
Structures in the tank farm area include the boiler house, processing building and loading rack. The structures will be disassembled and components thereof acceptable for salvage will be decontaminated and transported off-site. Components of the building (i.e., wood and fixtures) will be cleaned, if necessary, and then loaded into dumpsters and disposed of in an approved off-site disposal facility. Inert components of the structures (i.e., concrete, cinderblock and brick) will be staged in a controlled area for disposal in the on-site cell. The boiler from the boiler house and associated piping will be wipe tested for PCBs in accordance with Section 2.3.2 prior to disposal.

Foundations in the tank farm area include structure foundations, tank foundations, and pump pads. The foundations will be cleaned, "broken-up" and staged in a controlled area for disposal in the on-site cell. The materials will be broken up as necessary for subsequent incorporation in the compacted and controlled lifts of S/S material in the engineered cell. During materials placement, the materials will be distributed as uniformly as possible throughout the cell. These two steps will be taken to minimize voids in the fill, and any associated cap subsidence.

2.2.5 Subsurface Soils

Subsequent to the demolition and removal of the tank farm, the subsurface soils underlying the tank farm area will be graded in preparation of utilizing the area as a support zone for the solidification/stabilization process as described below. Figure 2-4 illustrates the preliminary layout for S/S activities.

The tank farm area will be regraded to slope approximately 1.5% to the southwest. This facilitates the management of precipitation as it collects in the corner formed by Lagoons Nos. 6, 4 and 1. Water collected in the "sump" will be transferred to the lagoons and/or water treatment plant as needed. Once graded, the area will be covered with geotextile fabric and then 8 inches of 3/4 inch stone. The extent of stone will cover an arc from the northeast corner of Lagoon No. 6 to the northeast corner of Lagoon No. 5 and will cover the outside of the berms presently



EXTENT OF 3/4 INCH STONE

SLOPE

CLEAN FILL STAGING AREA

RUBBLE STAGING AREA

S/S PROCESS AREA



MCLAREN/HART
ENGINEERS MIDWEST, INC.

PRELIMINARY LAYOUT
FOR S/S ACTIVITIES
COMMERCIAL OIL SERVICES SITE
OREGON, OHIO

DATE: 11-23-92

DRP-2000-01

separating the tank farm with Lagoons Nos. 4, 5 and 6. At a minimum, the graded area and stone will encompass all of the area presently occupied by the tank farm and the berms bordering the tank farm to the north and east. The temporary support zone operation will require the importation of 600 yd³ of 3/4 inch stone. The layout of this area is illustrated in Figure 2-4. Preparation of the tank farm area in this manner will enable the area to be used as a clean support zone in the interim to be used primarily to off load solidification/stabilization reagents from pneumatic trucks to the S/S processing plant. Approximately 20 trucks per day will be off-loaded at the Site during operation of the S/S plant.

At the conclusion of S/S operations, the soils beneath the former tank farm area will be excavated as necessary, (see Sections 2.2.6 and 2.2.7 for soil segregation and clean-up standards). Final grading of this area will be in accordance with the grading plan developed during the Removal Action design.

2.2.6 Soil Segregation Plan

Soil clean-up standards will be utilized to define the extent of soil excavation and demonstrate closure in the following areas of the Site:

- Tank Farm Area;
- Non-cell Lagoon Areas; and
- Other areas of the site from which contaminated soils may be excavated (i.e., drainage swale, the vicinity of above ground tanks, former drum storage area, etc.).

This section defines how soils will be segregated following excavation, Section 2.2.7 defines the soil clean-up standards for closure. The decision to S/S treat soils will be driven by total petroleum hydrocarbons and non-methane headspace, an indicator of VOC contamination. VOC contamination is the appropriate measure of clean-up effectiveness as the VOC's are the most mobile of the compounds at the Site and they are the components for which the lagoon sludge failed the TCLP test.

Soil excavation in the above cited areas will proceed until all visually contaminated soils are removed. Any excavated soil, which is highly contaminated and suspect of failing the TCLP test, will be incorporated in the sludge stream and S/S treated and placed in the on-site cell. For purposes of this Removal Action, any soil with a non-methane head-space reading of greater than 200 ppm will be S/S treated.

Soils that are visually cleaner will be field screened for total petroleum hydrocarbons (TPH) and non-methane headspace readings. Soils containing less than 600 ppm TPH and less than 50 ppm non-methane headspace as measured by the field screening techniques will be used as general fill between the S/S treated material and cap components in the on-site cell (see Section 2.4.4.1). This material may be temporarily staged as part of Removal Action Activities. Soils containing greater than 600 ppm TPH or 50 ppm but less than 200 ppm non-methane headspace as demonstrated by the field screening methodologies will be incorporated in the controlled lifts of the S/S treated material in the cell. Methodologies for non-methane headspace and TPH will be specified during the Removal Action Design.

Post-excavation soil samples will be collected and analyzed for TCL/TAL indicator parameters to demonstrate the appropriateness of closure. Areas exceeding the clean-up standard (see Section 2.2.7) will be re-excavated until the standards are achieved. Sampling frequency will adhere to Ohio hazardous waste regulations or the OEPA document titled, "How Clean is Clean Policy", and will be specified in the Removal Action Design Documents.

2.2.7 Soil Clean-up Standards

Soil clean-up standards will be based on background levels or risk assessment derived clean-up levels. The calculation of background contaminant levels as well as risk based levels will be in accordance with the Ohio EPA document titled, "How Clean is Clean Policy" dated July 26, 1991, for all areas of the Site not regulated under RCRA. For RCRA areas (Lagoon Nos. 1, 2, 6 and 7 and the Tank Farm), closure will be in accordance with OEPA hazardous waste regulations OAC-3745-66-11, OAC 3745-66-97 and 3745-67-28 (40 CFR 265.111, 40 CFR 265.197 and 40 CFR 265.228).

As part of the development of soil clean-up standards, a list of indicator parameters will be generated. This list will consider both risk based and regulatory driven standards. For example, the soils beneath non-cell RCRA lagoon areas (i.e., Lagoon No. 2) will be tested for indicator parameters such as benzene and trichloroethene, two compounds for which the sludge failed the TCLP test.

2.3 ASSOCIATED STRUCTURES AND DEBRIS

2.3.1 Underground Tanks

Two types of underground tanks are present at the Site, namely fuel tanks (3) and a septic tank(s). Two fuel tanks are located in close proximity to the fuel dispensers located directly east of the garage. The remaining fuel tank and known septic tank are located to the north of the garage. The fuel tank was used to fuel a boiler located within the garage and the septic tank was associated with the garage sanitary facilities.

2.3.1.1 Fuel Tanks

Closure of the three underground fuel tanks located on the Site will be in conformance with Ohio Administrative Code (OAC) Rule 1301:7-9-12. The State Fire Marshal, Bureau of Underground Tank Regulations (SFM, BUSTR) Site Feature Scoring System (SFSS) Guidelines have been utilized to score the underground tanks and establish clean-up goals. Upon scoring the underground tanks, it was calculated that the appropriate action levels are Category 4 Action Levels as listed below:

Constituent	Clean-Up Goals, (mg/kg)
Soil BTEX	0.500/12/18/85
Soil TPH (Gasoline)	600
Soil TPH (Others)	1156

The procedure outlining Tank Closure is described below:

- a) The tank and all associated piping runs will be excavated to the extent necessary for tank and piping removal. All excavated material will be staged on 20 mil UV-stabilized scrim reinforced geomembrane and covered the same material. Stockpile maintenance is described in Section 2.4.3.1.3.
- b) All tanks and piping will be emptied and removed from the excavation.
- c) A minimum of twelve inches of soil plus any visibly stained soils will be excavated from beneath all tanks, piping runs, and the dispenser island.
- d) Soil samples will be collected from beneath the ends of each tank, from beneath all piping runs at 20 foot intervals, from beneath any remote fill ports (> 10 feet from tank) and from beneath the fuel dispenser island.
- e) Upon receiving analytical results, excavation will continue, if necessary, to meet the above listed clean-up goals.
- f) All excavated soil will be S/S, if necessary, and placed in the cell.
- g) Tank contents will be analyzed for proper on-site/off-site disposal.
- h) Tanks and piping will be cleaned for salvage, to the extent practicable. All waters generated as a result of tank and pipe cleaning will be treated in the water treatment system.
- i) The excavations will be backfilled with soils similar to Site soils at the specific depth of excavation.

2.3.1.2 Septic Tanks

The septic tank(s) will be properly abandoned in accordance with Lucas County Department of Health guidance, as follows:

- Removal and proper disposal of residual waste;
NOTE: The waste will be sampled to assure proper disposal.
- Collapse tank in place;
- Removal of associated piping if constructed of transite (a white cement like pipe that contains asbestos); and
- Backfill with clean fill.

These procedures are in accordance with steps outlined by Mike Ariko of the Lucas County Department of Health (November 18, 1992 telephone conversation). No reporting requirements exist.

2.3.2 Above Ground Tanks and Debris

The classification of above ground tanks and debris includes all aboveground tanks and debris on-site exclusive of tanks and associated items contained in the tank farm area, the garage and the four known underground tanks located in the vicinity of the garage. Debris includes the following: concrete; roofing material; scrap material; other building materials; miscellaneous metals; plastic hose and piping; PPE; and truck body parts.

Removal of the above ground tanks and debris is anticipated to proceed as follows. Above ground tanks will be emptied, cleaned and salvaged as described in Section 2.2, titled Tank Farm Closure. Site debris will be evaluated on a piece-by-piece basis for ultimate disposition with on-site disposal the preferred alternative. On-site disposal will not be used for any item

identified as F-listed waste. Items that cannot be satisfactorily decontaminated will be disposed of in an appropriate off-site disposal facility. Above ground tanks and debris that are found to contain PCBs greater than 25 ppm will be wipe tested per 40 CFR 761.130 after decontamination. Decontamination of tanks and debris will achieve a cleanup level of 10 ug/100cm² for PCBs prior to salvage. As discussed in Section 2.4.5.0, biodegradable materials will not be placed in the engineered cell.

2.3.3 Buildings

The garage located on the northwestern portion of the Site is the major building on-site. The dismantling of the buildings near the tank farm was discussed in Section 2.2. During initial phases of the removal action, the garage will house the water treatment plant. Upon completion of the construction phase during which the garage will be needed, the garage will be demolished. Inert materials (i.e., concrete and block) from the structure will be disposed of in the on-site cell. All other material (i.e., wood, roofing material, misc. debris) will be loaded into trucks and disposed of in an approved off-site disposal facility. The boiler, associated piping and any miscellaneous wastes stored in the boiler room will be evaluated during the removal action construction for appropriate disposal. The boiler in the garage and associated piping will be wipe tested for PCBs in accordance with Section 2.3.2 prior to disposal.

2.4 LAGOON CLOSURE

This section details the various items associated with sludge treatment, disposal, and capping. An appropriate freeboard level will be initially attained and thereafter maintained in the lagoons until lagoon closure activities render freeboard maintenance unnecessary.

2.4.1 Impounded Water

Impounded water at the Site will be treated in an on-site water treatment system. The water treatment system may include one or more of the following unit operations: oil/water separation; pH adjustment/air stripping; clarification; multi-media filtration; oil absorption; carbon

adsorption and chlorination (ammonia control). The waters to be treated include all water currently impounded in the seven lagoons and the tank farm area, all precipitation that will collect in the seven lagoons and tank farm area during the removal action, and all decontamination waters generated as a result of the removal action.

The system will be sized accordingly for an estimated total volume requiring treatment of 14.7 million gallons. It is currently anticipated that water treatment operations will begin prior to other removal actions. The system will be designed to achieve the discharge standards listed in Table 2-1. It should be noted that the discharge criteria are generally consistent with criteria met during previous water treatment operations at the Site. These criteria have been developed by OEPA, and confirmed by EPA to meet applicable OEPA regulations (OAC 6111.042, OAC 3745-1-03 and OAC 3745-1-31 (40 CFR 122.44)). All water currently in Lagoon No. 5 will be treated, tested to ensure that the water meets the discharge criteria, and discharged directly to the stream with continuous operator surveillance during this procedure. Once Lagoon No. 5 is empty (approximately one month) the system will convert over to single shift surveillance, since treated water will be stored in Lagoon No. 5 for final analysis and discharge. At the time at which Lagoon No. 5 is removed from service (for use as a treated sludge storage area), direct discharge to surface water will be necessary. Appropriate effluent monitoring will be conducted throughout the water treatment operation. This monitoring frequency is as follows:

Discharge Scenario	Estimated Volume, Gallons	Sampling Frequency	Turnaround Time, Hours
Lagoon No. 5	800,000	Daily	24
Batch	6,200,000	Per Batch ⁽¹⁾	As necessary ⁽²⁾
Continuous	7,000,000+	Every other day	24
⁽¹⁾ One treated effluent grab sample will be collected per week.			
⁽²⁾ No discharge will occur prior to receipt of results.			

During the discharge of Lagoon No. 5 and the batch discharge phase of water treatment, a total of approximately 7,000,000 gallons of water will be treated over a period of approximately six

TABLE 2-1 WATER TREATMENT SYSTEM DISCHARGE CRITERIA	
Parameter	Effluent Criteria
Oil & Grease, mg/l	10
NH ₃ -N, mg/l	1.5
TSS, mg/l	30
Total Phenols, ug/l	10
pH, std units	6.5-9
Chromium, ug/l	54
Copper, ug/l	23
Lead, ug/l	30
Benzene, ug/l	5
Ethyl Benzene, ug/l	142
Trans 1,2-dichloroethene, ug/l	5
1,1,1 Trichloroethane, ug/l	88
Toluene, ug/l	2
Total Xylenes, ug/l	440
PCB (total), ug/l	ND

ND - Non-detect

months. This will generate approximately 26 effluent samples as a database to demonstrate the ability of the system to comply with NPDES standards.

2.4.2 Solidification/Stabilization (S/S)

This section presents a description of the solidification/stabilization (S/S) portion of the removal action for the Commercial Oil Services Site. The discussion is divided into major elements of the action related to the S/S of sludge as follows:

- Treatment Standards;
- Mix Design;
- S/S Process Equipment; and
- Air Pollution Control Equipment.

The S/S process will require careful coordination of various Site preparation issues and removal action activities. Following is a description of events as related to the S/S process that will be undertaken to effectively achieve the removal action objectives.

First, sludge from Lagoon Nos. 3, 4 and 5 will be removed and placed in Lagoon No. 1. After sludge removal, the interior berms between Lagoons 3, 4, and 5 will be removed. All visually contaminated soil on interior berm surfaces will be removed and segregated and treated as necessary per Section 2.2.6. All of the remaining portions of the interior berms will be excavated and staged on-site in a controlled staging area for subsequent use (see Section 2.4.4.1). Lastly, the staged potentially contaminated material removed from the surfaces of the interior berms will be leveled within the footprint of Lagoons Nos. 3, 4 and 5 and the space previously occupied by the interior berms associated with the lagoons. This potentially contaminated material will ultimately be excavated, treated by S/S, as necessary (see Section 2.2.6), and placed in the cell (see Section 2.4.3.1.3). This will create an area for S/S material to be stored after treatment and prior to placement in the on-site cell.

In conjunction with this activity, the S/S process equipment will be installed immediately to the east of Lagoon No. 5. First, the S/S process area will be properly graded and bermed. Next, a material transfer system will be installed in Lagoon Nos. 1, 2, 6 and 7. Following completion of the temporary berm between Lagoon Nos. 1 and 7 (see below), both the pumpable and non-pumpable material in Lagoon No. 7 will be treated or transferred to the east side of Lagoon No. 1. Prior to the construction of the on-site cell, all visually contaminated soils will be removed and subsequently S/S treated prior to disposal in the cell. Construction of the on-site cell will commence in the former Lagoon No. 7 area.

Following removal of the material from Lagoon No. 7, sludge from Lagoons Nos. 1, 2 and 6 will be transferred into the S/S process area via the material transfer system and treated. A description of the S/S process equipment and expected operating parameters is discussed in Section 2.4.2.3 titled, S/S Process Equipment. Treated material from the processing area will be placed in the staging area created from Lagoon Nos. 3, 4 and 5. Treated material will accumulate in the staging area until such time that the liner and leachate collection portion of the on-site cell is complete.

During the construction of the on-site cell, an area of sludge will be stabilized in place to serve as a temporary berm to facilitate construction of the cell in two sections. The berm will lie within Lagoon No. 1 and will bi-sect the cell footprint in a north/south direction. Transfer of material from Lagoon Nos. 1, 2 and 6, S/S treatment and placement of the treated material in the staging area and then the completed half of the on-site cell will continue. At such time that a sufficient volume of material has been removed and treated from Lagoon Nos. 1, 2 and 6, the remaining half of the cell will be constructed. This will include the removal of the temporary S/S sludge berm and its placement within the completed portion of the cell. Upon completion of the remainder of the cell, the treated material in the staging area will be placed in the cell, additionally, newly treated material will take a more direct route from the process area to the cell, essentially eliminating the utilization of the staging area and the associated double handling.

Transfer of material from the remaining sections of Lagoon Nos. 1, 2 and 6 will continue to completion, with material being treated and placed in the cell. Upon completion of the treatment

phase, the material transfer system and S/S process equipment will be decontaminated and demobilized to facilitate the removal action in non-cell areas as discussed in Section 2.4.3.1.3 of this Plan.

2.4.2.1 Treatment Standards

The treatment standards of the S/S process designed for the Removal Action at the Commercial Oil Site are as follows:

- Pass all TCLP parameters on S/S treated sludge;
- Achieve a bearing capacity of 1.5 tons per ft² on S/S treated material to assure cap constructibility and long-term stability; and
- Capture and treat organic vapors and dust in the off-gases from the in-vessel S/S treatment unit.

The results achieved during the S/S Treatability Study indicate that the selected S/S mix design (Mix 3) will be successful in meeting the first two treatment objectives.

2.4.2.2 Mix Design

During the S/S Treatability Study, numerous S/S reagents and mixture ratios were investigated. Following is a brief description of the performance of the best S/S reagents and mixture ratio for the Site sludge as determined during the Treatability Study as detailed in the May 1992 final report.

The treatability study demonstrated, in pilot scale, that Site lagoon contents could be treated through a S/S process to ensure that the resultant materials pass the TCLP test and would not be hazardous waste. Mix number 3 of the study, which consists of lime kiln dust and portland cement in a 3:1 ratio, successfully treated Commercial Oil Services Site sludge to meet all treatment objectives. Specifically, the sludge treated with Mix 3 passed TCLP for volatiles,

semi-volatiles and metals, and achieved a minimum bearing capacity 1.5 tons/ft². In addition, Mix 3 passed the paint filter test.

A summary of the projected dosages for Mix 3, by lagoon, can be found in Table 2-2. This table also presents the measured volume expansion on a per lagoon basis.

Utilizing the distribution of material volume and mass by lagoon, (as discussed in Section 2.0. of the Treatability Study), weighted averages for reagent dosage and volume expansion were calculated for the entire lagoon system. The results of this analysis are as follows:

- Average dosage 98% by wet weight; and
- Volume expansion 38%.

2.4.2.3 S/S Process Equipment

The in-vessel S/S treatment system is a generic treatment system that can handle all Site waste streams which are to be S/S. Figure 2-5 illustrates the S/S Process Equipment. The treatment units that would be required, exclusive of reagent handling and controls, at the Site to process the material would include the following:

- dredge;
- vibrating screen;
- solids handling pump;
- high intensity mixer;
- reactor/dryer
- treated material discharge conveyor; and
- air pollution control system.

In operation the dredge, most likely one or two cranes equipped with a clam shell or other suitable device for the handling of high and low solids content material, will transfer sludge to a vibrating screen. The vibrating screen will remove solids in excess of 2 inches in diameter.

TABLE 2-2 ESTIMATED DOSAGE AND REAGENT VOLUME EXPANSION FOR MIX 3		
Lagoon Sample No.	Dosage (% by Wt.)	Volume Expansion (%)
1 North	120	42
1 South	125	48
2	20	18
3/4	30	16
6	140	73
7 North	65	29
7 South	85	24
Weighted Average	98	38

The screen will automatically transfer the large solids to a "reject" bin. Solids that are either too large or of a shape not compatible with the automatic rejection feature of the screen will be manually removed from the unit into the "reject" bin. "Rejected" material will be transferred to the decontamination pad in the vicinity of the garage and pressure washed. The washed/decontaminated material will then be handled as debris as described in Section 2.3.2. Material passing the 2 inch screen will be pumped to the high intensity mixer, using a suitable piston pump.

The pump type will be selected to handle 2 inch diameter solids and the range of sludge viscosities that will be encountered on Site. The pump will be sized to handle the estimated throughput of the system. Within the high intensity mixer, the material will be intimately mixed with the S/S reagents. Reagents will be metered to the mixer utilizing two reagent specific hoppers; and volumetric feed units. Volumetric feeders will be utilized for both reagents and sludge/soil materials. The volumetric feeder units will be factory calibrated and feed rates will be recorded. This will provide records that the material was S/S treated in accordance with the Treatability Study results. Reagents will be off-loaded from pneumatic trucks into the reagent hoppers, the hoppers will be sized to hold a suitable volume of reagents to allow uninterrupted processing during change over of delivery trucks.

The reagent/material mixture will be dropped from the high intensity mixer to the reactor/dryer. The reactor/dryer consists of a single unit; in the reactor section the hydration reaction will occur in the reagent/material mixture. The reactor/dryer will mechanically transfer the hydrated reagent/material mixture to the dryer section of the unit. Within the dryer section, which will be sized to provide a 30 minute detention time, the mixture will be further mixed and exposed to the atmosphere within the dryer to facilitate volatile removal. The reactor/dry unit will be maintained at a slightly negative pressure (approximately 3 inches of water) with off-gases being sent to the Air Pollution Control (APC) System (see Section 2.4.2.4 of this report for a description of the APC System).

The treated material will be transferred to the sludge staging area created within Lagoons 3, 4 and 5 using a discharge conveyor. This conveyor is a motor driven cupped belt sized to handle the system throughput.

The S/S system will treat approximately 513 yd³/day of material. Operation will be 24 hours/day, with 20 hours/day of processing assumed, resulting in a system throughput of 26 yd³/hr. The dredge, vibrating screen, and pump will be sized accordingly. Accounting for the 38% volumetric increase associated with reagent addition, all units from the high intensity mixer to the discharge conveyor will be sized to handle 36 yd³/hr.

S/S process monitoring will consist of paint filter testing, bearing capacity testing and reactor/dryer temperature monitoring. A correlation will be developed between short-term (1 day) bearing capacity and 28 day bearing capacity based upon data generated during the Treatability Study. These two parameters will provide feedback that a sufficient reagent dosage has been added, resulting in the previously demonstrated (Treatability Study) process efficiency.

2.4.2.4 Air Pollution Control System

The Air Pollution Control (APC) system shall be capable of capturing and controlling the following:

- Particulate and associated adsorbed/absorbed contaminants;
- Organic compounds; and
- Acid gas resulting from chlorinated hydrocarbon destruction.

As currently envisioned, approximately 2,000 SCFM of off-gas will be collected from the reactor/dryer section of the in-vessel S/S process by maintaining a slight negative pressure on the unit with an induced draft fan. The air will then flow through an venturi quench tower which will reduce the gas stream temperature to ambient and condense potential PCB vapors. The air will then flow through a wet electrostatic precipitator for particulate and condensed PCB

removal. The particulate (expected to be primarily lime kiln dust and portland cement) will be containerized and returned to the S/S process.

The off-gas will be drawn into the catalytic oxidation unit by a fan, and discharged into the system heat exchanger (50 percent efficient shell and tube type). The off-gas then passes through the tube side of the exchanger (to recover waste thermal energy) and into a burner (propane or natural gas fired) where the temperature is raised to the catalyzing temperature (600-850°F). The off-gas then passes through the specialty catalyst, and during the exothermic reaction, organic compounds are converted to carbon dioxide, water vapor and inorganic acids. The gas then exits the catalytic oxidation unit, the outlet temperature is monitored as a process control variable to assure a sufficient temperature for oxidation of contaminants. The gas then passes through the shell side of the heat exchanger to preheat the incoming air. Conveyance of the gas stream through the shell and tube sides of the heat exchanger is not a treatment step but a standard heat transfer operation to recover the heat in the oxidation unit exhaust to preheat the input gas stream to the burner, thereby achieving the necessary oxidation temperature of 600-850°F, while minimizing fuel input. Catalytic oxidation was selected over other means of organics removal (direct thermal destruction, carbon adsorption) as it was deemed the most appropriate technology.

In order to neutralize the inorganic acids (primarily HCl), a quench chamber and packed tower scrubber is envisioned. Sodium hydroxide (NaOH, caustic) would be fed into the recirculating system. Inorganic salts (primarily NaCl) would then be discharged to the on-site treatment system to be handled with the other wastes. The treated air stream would then pass through a demister and exit the packed tower.

The APC system discussed above is Best Available Technology (BAT). On a unit process basis, typical removal/destruction efficiencies, as provided by equipment suppliers are as follows:

Unit	Purpose	Typical Efficiency, %
Quench Tower	Temperature Control	NA
Wet Electrostatic Precipitator	Particulate Removal	> 90
Catalytic Oxidizer	Volatile and Semi-volatile Organic	> 95
Scrubber	Acid Gas (HCl) Absorption	> 90
NA - Not Applicable		

The above process units have, to McLaren/Hart's best knowledge, not been utilized on an S/S process air stream. As such, actual operating efficiencies during full-scale operation cannot be predicted at this time. The system will however, be designed in accordance with best engineering practices, and subsequently constructed, operated and maintained accordingly. During the S/S System Performance Test (see Section 2.4.2.5), the efficiency of the APC unit will be determined under one set of operating conditions. Process control variables will be monitored during the test, and subsequently, utilized, as appropriate, during full-scale operations to ensure system performance. Air flow rates, technology and operating conditions to ensure APC system removal/destruction efficiencies will be confirmed during Removal Action Design. Stack emissions testing is discussed in Section 2.4.7.

2.4.2.5 System Performance Testing

The ability of the selected S/S reagent mixture to treat Site lagoon material to pass the TCLP, bearing capacity and paint filter test standards was established during the Treatability Study on a pilot-scale basis. System performance testing is designed to demonstrate that the selected S/S reagent mixture and proposed S/S equipment will achieve the same treatment standards in a full-scale operation. Performance testing will be conducted after the completion of S/S system installation and mechanical shake-down. In addition, the performance of the APC system will be determined during the performance testing program, as will the S/S process operating conditions.

Previous sampling results have shown that sludge from Lagoon No.7 has the highest contaminant concentrations (as measured by total volatile and TCLP volatile analysis). Therefore, sludge material from Lagoon No.7, will provide a conservative approach to the testing. The performance test will be conducted for 24 hours of operation. During this performance test, the reactor/dryer temperature and pressure, and reagent feed rate will be closely monitored and recorded to establish acceptable process monitoring standards for the subsequent full-scale operation. Treated samples will be collected from the S/S material at three intervals (e.g., once every shift). Triplicate samples will be collected from the S/S material generated from that shift and tested for the following parameters:

- TCLP volatiles;
- Unconfined compressive strength; and
- Paint filter test.

Samples will be prepared using appropriate ASTM procedures and cured for 28 days before the TCLP testing. However, in order to expedite the performance demonstration, samples may be tested sooner for TCLP. Tentatively, it is proposed that unconfined compressive strength tests will be conducted after 1 day, 2 days, 3 days, 7 days, 14 days and 28 days of curing. These data, along with the data generated during the Treatability Study will be used to develop a correlation between short-term (1 day) and 28 day bearing capacity. The short-term bearing capacity will be used as a process control parameter during the full scale operation.

In order to achieve the goal of determining APC performance (in terms of removal/destruction efficiency), stack testing (as discussed in Section 2.4.7.2) will be conducted during the system performance test. This data will be utilized to determine APC performance. In addition, APC process control variables (such as electrostatic precipitator power settings, and catalytic oxidizer catalyst inlet temperature) will be monitored during the test. These control variables will be utilized to determine appropriate settings for subsequent APC unit operation during production.

The S/S system will not be operated for production purposes until the testing data demonstrate that it is operating within an acceptable range, and EPA has accepted the results. A detailed plan

for system performance testing will be prepared during the Removal Action Design phase of work.

2.4.3 Containment Cell

The S/S material will be located to an engineered cell. This section describes the pertinent information relative to this containment (engineered) cell.

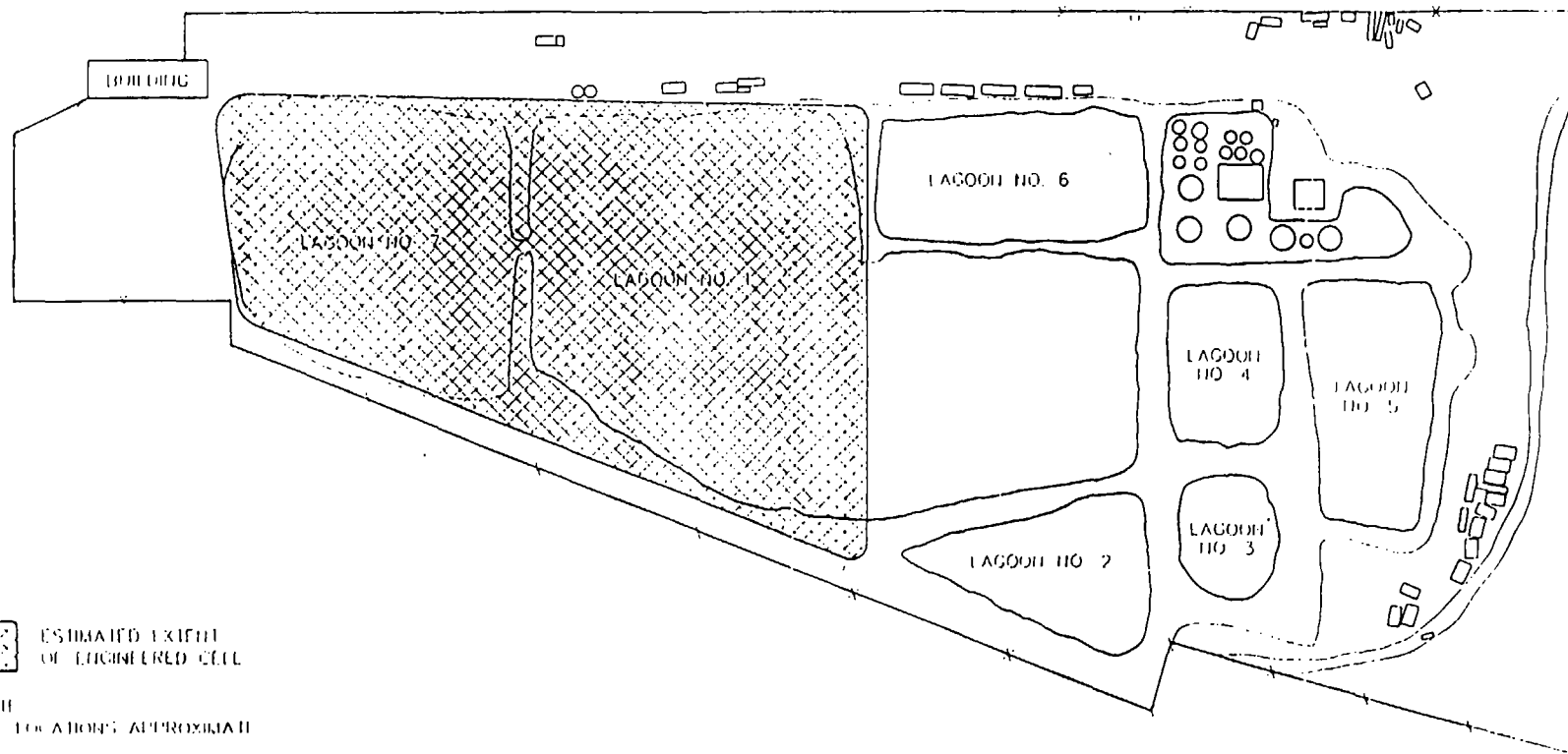
2.4.3.1 Cell Footprint

The preliminary engineered cell footprint is illustrated in Figure 2-6. The following section discusses issues related to cell footprint selection and includes the following major elements.

- Disposal volume;
- Containment cell configuration; and
- Plan for non-cell areas.

2.4.3.1.1 Disposal Volume

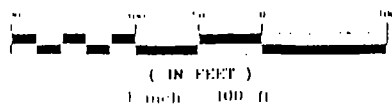
The total volume of stabilized sludge and soil to be placed in the containment cell has been estimated. The estimated volume of raw sludge is approximately 77,000 yd³. Based on information contained in the Treatability Study, the post-stabilization sludge volume will increase approximately 38 percent, for a total treated sludge volume of 106,300 yd³. It was assumed that an additional 13,700 yd³ of material may be disposed in the completed cell. This material would consist of soils, concrete, debris and other appropriate materials. Therefore, the total estimated volume of material to be located in the containment cell is approximately 120,000 yd³.



ESTIMATED EXIST
OF ENGINEERED CELL

DOH
ALL LOCATIONS APPROXIMATE

GRAPHIC SCALE



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OREGON, 97103

2.4.3.1.2 Containment Cell Configuration

An evaluation of containment cell configuration required to accommodate the estimated disposal volume has been performed. The preliminary containment cell option was evaluated as described below:

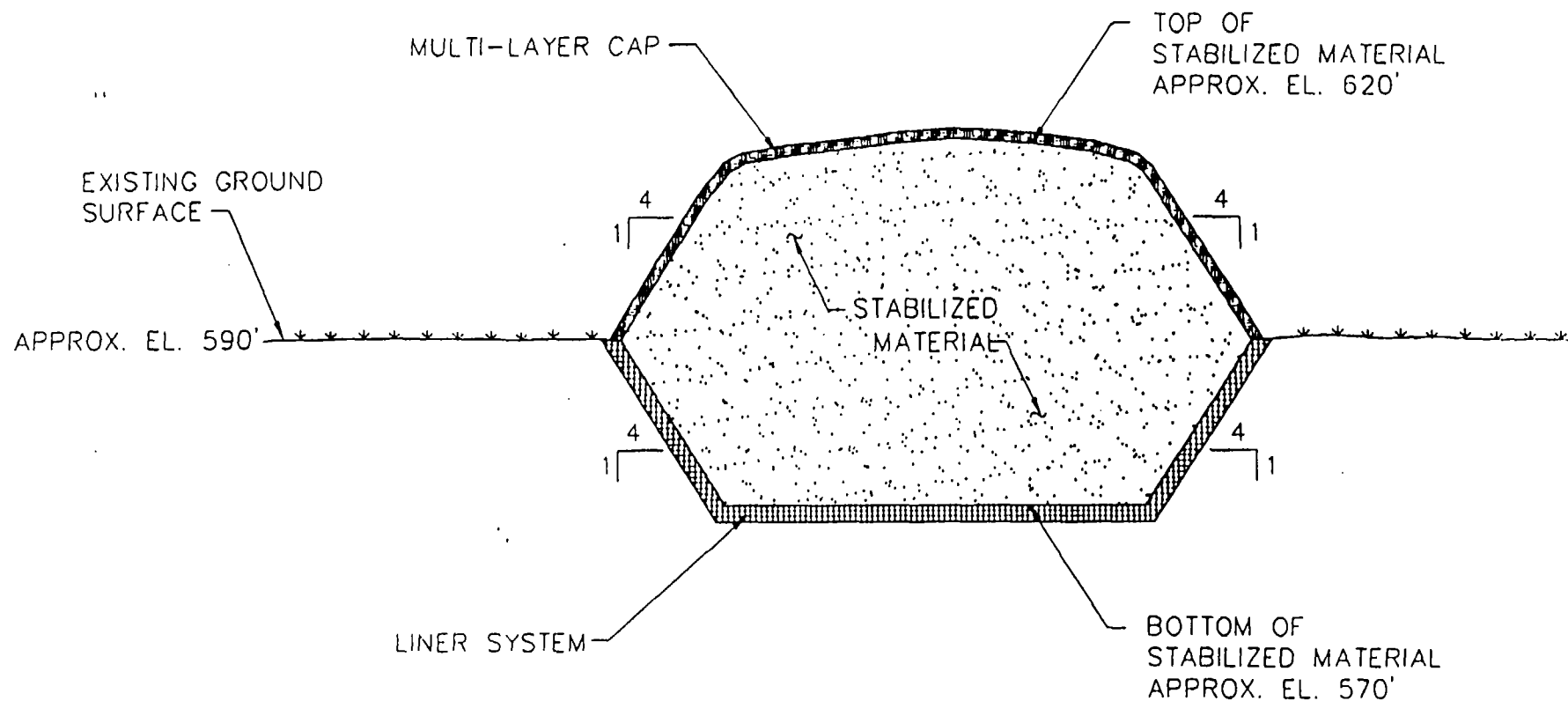
The option includes the design of a cell with a horizontal extent of approximately three acres. This iteration involved a maximum 4H:1V (Horizontal to Vertical) slope for the base grades and a maximum 4H:1V for the fill slopes. The assumed bottom base grade is 570 ft. MSL and the assumed top fill slope is 620 ft. MSL. This option would result in a 30 feet high prismoidal shape above the existing grades at the facility. This approximate configuration would be adequate to accommodate the total disposal volume of 120,000 yd³. A cross-section of the conceptual containment cell configuration is provided in Figure 2-7.

During Removal Action design, the engineer will use this option as a baseline to select the final configuration. Once a final configuration has been selected, the base grades and final grades will be established.

2.4.3.1.3 Plan for Non-Cell Areas

All non-cell areas can be classified into one of three categories. Namely lagoon areas not contained within the cell footprint, the tank farm area, and other non-lagoon areas not contained within the cell footprint. Lagoon areas not included within the cell footprint include Lagoon Nos. 2, 3, 4, 5, 6, and the eastern third of Lagoon No. 1.

During S/S activities, and following material removal, contaminated subsoils of Lagoon Nos. 2, 6, and the eastern third of Lagoon No. 1 will be excavated, segregated, and treated, as necessary. Contaminated subsoils will be removed until background levels or a risk based clean-up standard is achieved (see Sections 2.2.6 and 2.2.7). During the 1989 EE/CA Investigation 27 samples were collected from lagoon subsurface soils. The maximum extent of contaminated penetration was 12 inches. Based on this information, it is estimated that the removal of



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approximately 12 inches of lagoon subsurface soils may be required as part of the Removal Action. During S/S activities, Lagoon Nos. 3, 4, and 5 will be utilized as a treated material staging area, as outlined in Section 2.4.2 of this report. Upon completion of material removal activities from Lagoon Nos. 1, 2, and 6 and prior to demobilization of the S/S process equipment, the impacted soils in Lagoon Nos. 3, 4 and 5 area will be excavated, treated by S/S as necessary (see Sections 2.2.6 and 2.2.7), and placed in the on-site cell. Excavation of this area will proceed until background levels or a U.S. EPA approved risk-based clean-up standard is achieved. This will result in the decommissioning of the treated material staging area, and establishment of all non-cell lagoon areas as clean.

The tank farm area will be used throughout the S/S phase as a support zone (as outlined in Section 2.2.5 of this report). Upon completion of S/S activities, the 8 inches of 3/4 inch stone and impacted subsoils will be excavated as necessary until background levels or a U.S. EPA approved risk-based clean-up standard is achieved, thereby establishing this area as clean. The material will be segregated and handled as described in Section 2.2.6 and 2.2.7.

The third category, which includes all other non-cell areas on-site, will require the excavation and disposal of various Site soils into the engineered cell, as necessary to achieve the closure standards specified in Section 2.2.7. The following soils will be included:

- All impacted soils in the area north of Lagoon Nos. 1 and 6 and south of the Site fence;
- Site soils under above ground tanks and debris where contaminated;
- Soil associated with the closure of the underground fuel tanks;
- Sediments in the drainage swale located on the eastern portion of the Site; and
- Any other Site soil that is visually contaminated.

Following the excavation and disposal of soils from all non-cell areas, the Site will be graded and returned to its original (pre-lagoon) topography, as appropriate. Specifically, all non-cell areas of the Site will be graded to provide a smooth transition into local ground surface

elevations and slopes. Earthen fill and topsoil will be imported as needed. Topsoil will be placed to a minimum thickness of 4 inches in all non-cell areas.

Contaminated soils will be stockpiled, if necessary, on 20 mil UV-stabilized scrim reinforced geomembrane. The stockpiled soils will be covered with 20 mil UV-stabilized scrim reinforced geomembrane to minimize erosion from the stockpile. The sides of the piles will be dressed to a slope of approximately one vertical to two horizontal. The top of the pile will be graded to ensure drainage without bumps or hollows which would pond water. Runoff will be collected, and appropriately treated. Damage to the stockpile cover will be promptly repaired. These soils will be disposed along with other soils and treated sludges in the engineered cell. It is anticipated that above described soils will be excavated and placed directly into the engineered cell after the conclusion of sludge S/S treatment. Therefore, storage may not be necessary.

2.4.3.2 Soil Liner System

This section provides a basic geological summary and discusses the soil liner system in terms of its physical requirements and testing requirements for its construction. The soil liner system issues are presented in the following format:

- Basic Geology Summary;
- Physical Requirements; and
- Testing Requirements.

2.4.3.2.1 Basic Geology Summary

The geology of the area which encompasses the Commercial Oil Services Site can be characterized in basic terms as a thick sequence (approximately 90 feet) of glacial deposits which directly overly Silurian and Devonian Age Carbonate bedrock. The lacustrine deposits are generally brown in color and are characterized by the presence of varied layers (fine laminations) of silt and clay. The permeability of the upper and lower tills ranges between 1.0×10^{-7} cm/sec to 1.0×10^{-9} cm/sec as documented in the RCRA Part B applications from EnviroSAFE and

Standard Oil Company (BP) (These permeabilities are based upon soils testing by independent geotechnical laboratories). Sands and gravels may also be present but are generally limited to thin (less than two feet) stringers which are laterally discontinuous.

2.4.3.2.2 Physical Requirements

Construction of the low permeability soil liner will include excavation of the in-situ clays to achieve the subbase grades. Subsequent to final grading, the surface of the clay will be compacted using appropriate compaction equipment. The low permeability soil liner will consist of a minimum four (4) feet of low permeability soil (permeability of less than or equal to 1×10^{-7} cm/sec) and shall be constructed in accordance with 40 CFR 761.75. Permeability testing will be performed per Section 2.4.3.2.3.

If sand or gravel stringers are encountered within the subbase, the sand or gravel will be removed up to a depth of four (4) feet and replaced with low permeability soil, as necessary to construct the liner. Additionally, following excavation of the base grades for the sideslopes, this material will be tested as described in the following section. The sideslope soil may be more heavily weathered than the soils encountered at lower elevations, requiring removal and backfilling with four (4) feet of low permeability soil.

2.4.3.2.3 Testing Requirements

This section describes the field and laboratory testing requirements for the low permeability soil component of the liner system.

Laboratory Testing

The minimum laboratory testing requirements for the low permeability soil are described below:

Parameter	ASTM Designation
Particle size	D422-63
Moisture/Density	D2216-80
Atterberg limits	D4319-84
Permeability	D5084 or D2434

Following receipt of the laboratory results, the engineer will prepare a correlation between the moisture-density relationship and permeability results. These results will be presented in tabular or graphical format used as "acceptable zones" to form a basis for acceptance or rejection of soil compaction in the field.

Field Testing

Initially, the depth of the in-place low permeability soil will be evaluated using a portable drill rig (or comparable piece of equipment). The soil material will be tested on a 150 ft. grid system interval, to a depth of four feet below grade. In addition, at five additional locations, which locations will be subject to EPA approval, the depth of in-place low permeability soil will be determined. These locations will be located based upon actual Site conditions encountered during construction. Undisturbed soil samples (drive tubes) will be tested at one foot intervals (4 total per location) during the drilling operations. These undisturbed soil samples will be laboratory tested for particle size, and Atterburg limits. One sample per boring will be tested for permeability. The physical data (particle size and Atterburg limits) will be utilized to demonstrate that the in-situ material is homogeneous and that there is a minimum of 4 feet of continuous low permeability (1×10^{-7} cm/sec) soil liner. The void created as a result of the soil borings will be backfilled with a bentonite slurry.

Additionally, a test pad will be constructed of the low permeability soil material to provide field verification of the moisture/density/permeability relationships obtained from the geotechnical laboratory tests. The test pad will have approximate dimensions of 30 ft. wide by 60 ft. long and is constructed in a series of eight 6 inch lifts for a total thickness of four feet. Testing is

performed on each lift, and includes density and moisture measurement, and permeability. Compaction as-built information is logged in relation to tests to allow the correlation between construction procedures and liner performance. The purpose of the test pad is to establish a sequential and logical approach for the development of soil placement and compaction procedures to be used during installation or preparation of low permeability soil.

During the course of soil liner construction (recompaction of clay), field moisture/density determinations will be performed using a nuclear density gauge. These results will be compared to the acceptable zone created from the laboratory test results to form a basis for acceptance or rejection of soil compaction results.

2.4.3.3 Leachate Management System

The leachate collection system for the containment cell will be designed and constructed in conformance with the requirements of 40 CFR, Part 761.75. The leachate will be collected via a granular drainage layer and piping network that will flow by gravity to the leachate collection sump. During construction, the leachate (including stormwater runoff) will be treated at the on-site treatment facility. Following construction operations, leachate generated (if any) will be treated off-site. A brief description of the major components of the leachate management system are described below:

2.4.3.3.1 Drainage Layer

Two potential drainage systems will be evaluated for the purpose of this design. The drainage systems will consist of either a synthetic drainage net/geotextile composite or a granular drainage material layer. If a granular layer is specified, the design engineer will evaluate the necessity of placing a geotextile above the granular material.

2.4.3.3.2 Leachate Collection Piping

Leachate that is transmitted through the granular drainage material layer will be collected via a network of perforated pipe that is surrounded by coarse aggregate stone material. Based upon the proposed containment cell subgrade and the results of the leachate generation calculations, the leachate collection pipes will be sized. The system will be designed to safely convey the anticipated worst case projected leachate flow. The piping network will also be evaluated to determine the minimum strength characteristics of the pipe required due to equipment loads during construction and due to maximum projected waste grades. Chemical compatibility of pipe and leachate will also be investigated.

A detail of the liner system/leachate collection system is provided in Figure 2-8.

2.4.3.3.3 Leachate Collection Sump

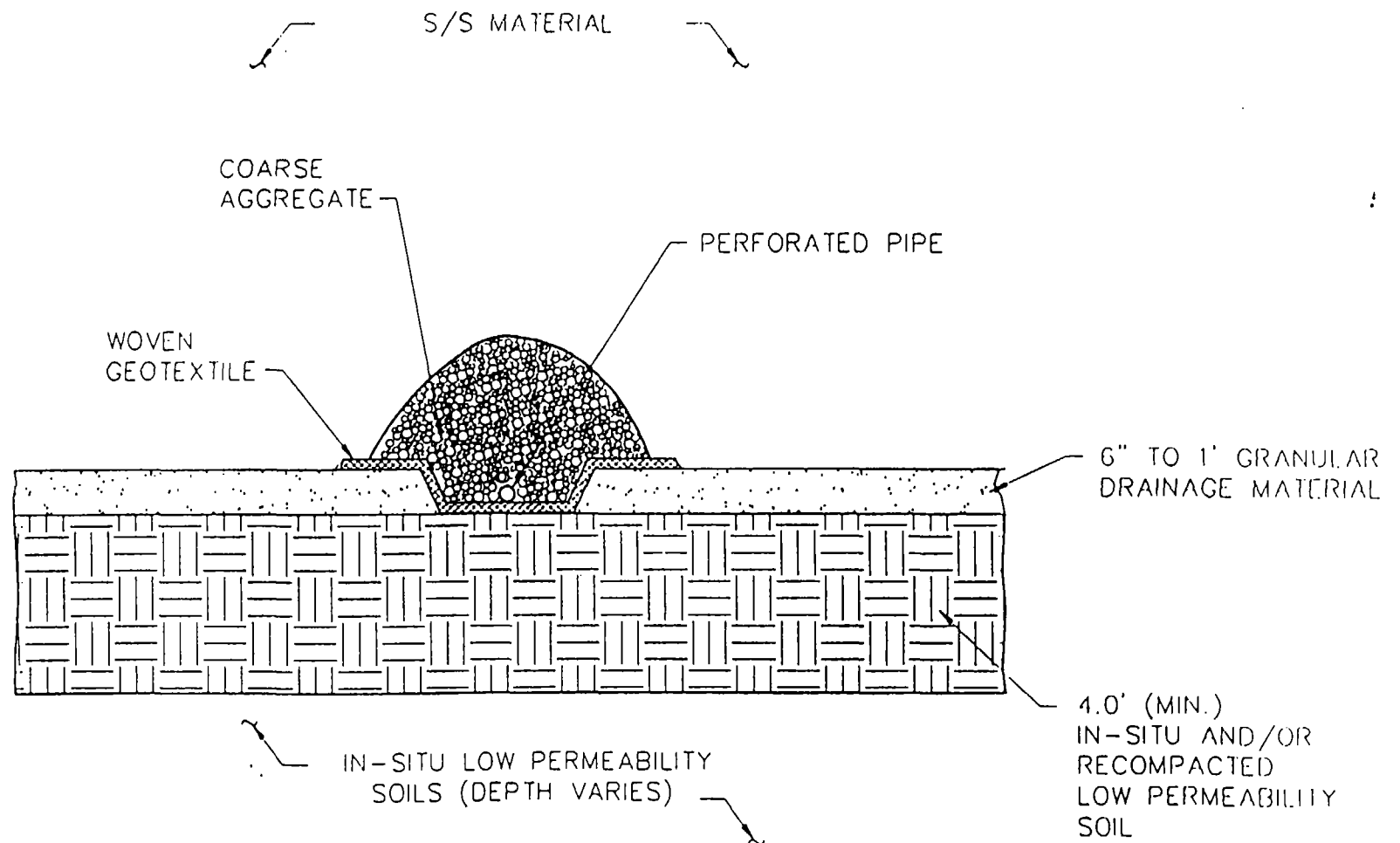
The leachate collection sump(s) will be located at the low point of the gravity flow system. Leachate will be removed from the collection sump using a sump pump within a sideslope riser pipe. Calculations will be performed to adequately size the volume of the collection sump, the size of aggregate in the sump and the size of the sump pump and sideslope riser.

2.4.4 Multi-Layer Cap

A multi-layer cap, tied into the liner system, will make-up the upper containment portion of the engineered cell.

2.4.4.1 Cap Configuration

A multi-layered cap system will be placed above the engineered cell. The cap system will be designed and constructed to meet the requirements of 40 CFR Section 265.310 and the standards described in the document titled, "Final Covers on Hazardous Waste Landfills and Sludge Impoundments". The cap will consist of the following components (in descending order):



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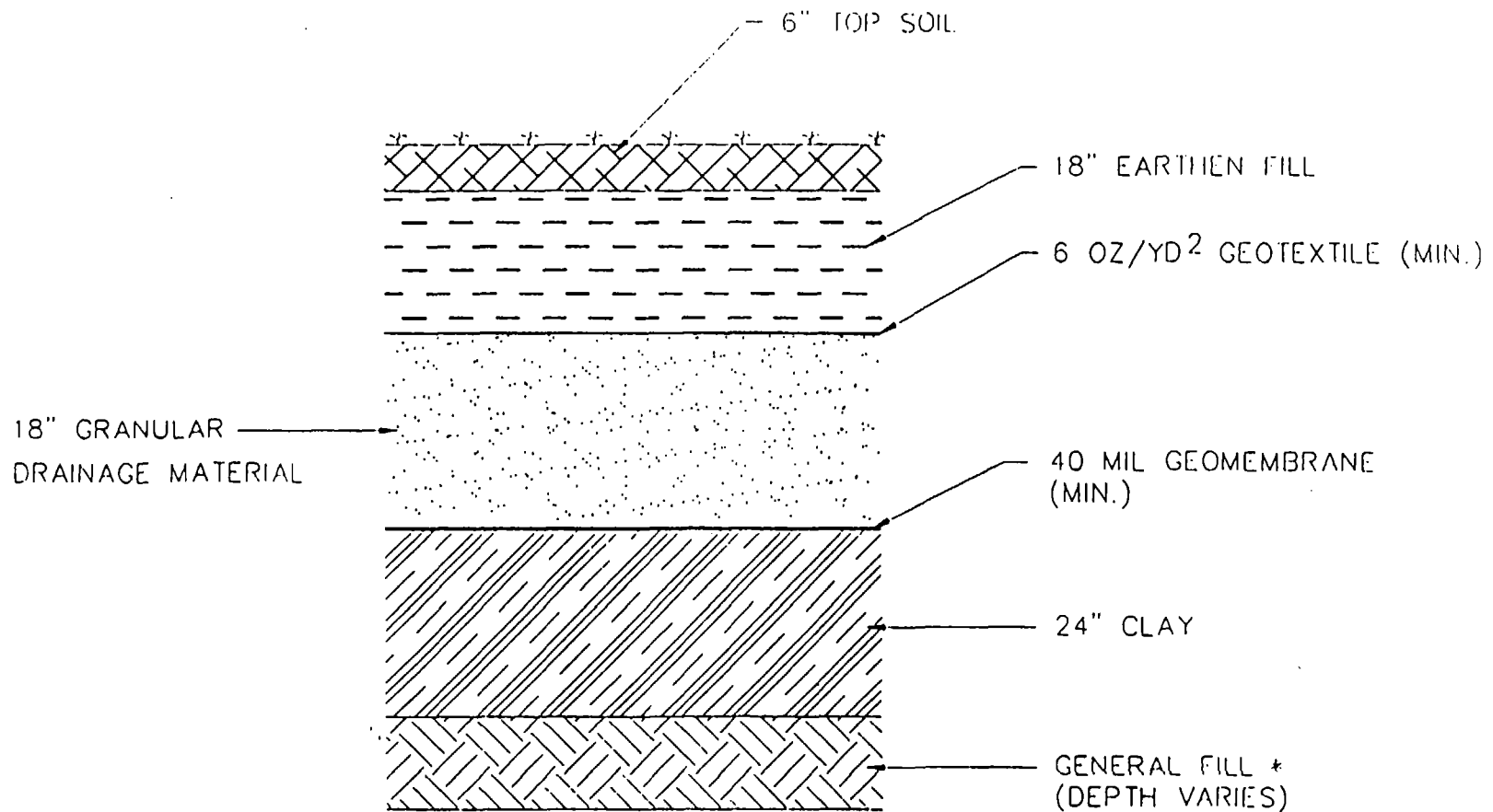
LINER SYSTEM AND LEACHATE
PIPING SYSTEM CROSS SECTION
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- Six inches of topsoil (vegetative layer);
- 18 inches of earthen fill material;
- Geotextile layer;
- 18 inches of granular drainage material;
- Synthetic geomembrane; and
- 24 inches of compacted low permeability soil.

A detail of the proposed cap system is provided in Figure 2-9. During the design phase this proposed cap configuration will be analyzed for slope stability characteristics.

A brief description of each component is described below:

- Topsoil - will consist of soil capable of providing the proper base for establishing surficial grasses for erosion protection. The topsoil material selected will be reasonably free from clay lumps, brush, roots, weeds, other objectionable vegetation, stones or other foreign materials.
- Earthen fill - will consist of soil that is obtained from off-site borrow sources. The general earthfill selected will be free of organics and other deleterious materials.
- Geotextile Layer - will consist of a polypropylene non-woven fabric. All seams will be sewn with polypropylene thread. Fabric weight will be approximately 6 oz./yd².
- Granular Drainage Material - will consist of a competent, well rounded, subangular stone material. One hundred percent of the material selected will pass a three-quarter (3/4) inch sieve. The permeability requirements of the granular drainage material will be established during the final design phase. The design engineer will evaluate the potential of replacing the granular drainage layer with a synthetic drainage net material.



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S/S MATERIAL

* GENERAL FILL IS NOT A COMPONENT OF THE CAP. IT WILL BE USED TO OBTAIN PRE-CAP CONSTRUCTION GRADES ON THE S/S TREATED MATERIAL.



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- Synthetic Geomembrane - will consist of a 40-mil High Density Polyethylene (HDPE) layer. The design engineer will also evaluate the potential of using alternative geosynthetic materials such as Very Low Density Polyethylene (VLDPE). HDPE and VLDPE are commercially available sheets that can be fabricated with a "smooth" or "textured" surface. The design engineer will evaluate the stability characteristics of the final slope configuration to determine the recommended material type to be used. The typical property requirements for HDPE and VLDPE are provided in Table 2-3.
- Low Permeability Soil - will consist of a natural select material free of organics, excess silt, or other deleterious materials. The material selected will have a compacted coefficient of permeability of 1×10^{-7} cm/sec or less. The low permeability soil will have a maximum clod size of one-half the lift thickness and a maximum particle size of three-quarter (3/4) inches.

General fill, obtained from on-site and/or off-site borrow sources, while not a component of the cap, will be placed on top of the S/S treated and other fill material to obtain suitable pre-cap construction topography (i.e., grade, slope, etc.).

2.4.4.2 Grading Plan

The conceptual configuration of the containment cell was presented in Section 2.4.3.1.2. The final grading plan will be designed to promote runoff and prevent ponding of stormwater. Calculations will be performed to evaluate the slope stability of the proposed cap system. The design engineer will attempt to limit the final grades to a maximum 4H:1V slope.

2.4.4.3 Testing Requirements

The purpose of this section is to describe in general terms the testing requirements for the soil and geosynthetic components of the capping system.

TABLE 2-3 40 MIL HDPE AND VLDPE GEOMEMBRANE PROPERTIES			
Property	Specified Value HDPE	Specified Value VLDPE	Test Method
Thickness (min. avg. mils)	40	40	ASTM D751
Thickness (min. mils)	36	36	ASTM D751
Specific Gravity (geomembrane, min. g/cc)	0.940	0.935	ASTM D1505 or ASTM D792 Method A
Melt Flow Index (resin, g/10 min.)	0.1 to 1.1	0.1 to 1.1	ASTM D1238 (Condition E, 190°C/2.16 kg)
Tensile Properties: (each direction)			ASTM D638
1. Yield strength (min. lb/in width)	88	*	
2. Break strength (min. lb/in width)	152	140	
3. Elongation at yield (min. %)	12	*	
4. Elongation at break (min. %)	600	*	
Tear Resistance Initiation (min. lb)	28	16	ASTM D1004 Die C
Puncture Resistance (min. lb)	72	*	ASTM D4833
Low Temperature Brittleness (max. °C)	(-60)	(-60)	ASTM D746 Procedure B
Carbon Black Content (%)	2.0 to 3.0	2.0 to 3.0	ASTM D1603
Carbon Black Dispersion	A-1 or A-2	A-1 or A-2	ASTM D3015
Dimensional Stability (each direction, max. change, %)	± 2.0	± 2.0	ASTM D1204
Environmental Stress Crack (min. hours)	2,000	2,000	ASTM D1693

NOTE: *Properties not available from manufacturer.

Geomembrane

Geomembrane testing will occur for quality assurance/quality control testing prior to and during construction. The purpose of this section is to describe the general testing requirements for the geomembrane.

Initially, quality control documentation will be provided by the geomembrane manufacturer or installer. The general quality control documentation requirements are described below:

- resin quality control certificates;
- polymer quality control certificates;
- quality control certificates with results for; thickness, specific gravity, tensile properties, tear resistance initiation, carbon black dispersion, and carbon black content.

Following delivery of the geomembrane to the Site, test samples will be collected and sent to the QC laboratory for conformance sampling. At a minimum the following properties shall be tested: polymer composition; polymer specific gravity; carbon black content; carbon black dispersion; thickness and tensile properties.

During geomembrane placement, several types of testing will be conducted. Trial seams will be performed on the geomembrane to verify that seaming conditions are adequate. Trial seams will be performed at the beginning, middle and end of each work day. The specimens will be tested for peel and shear using a field tensiometer. A portion of the trial seams will be sent to the QA laboratory for peel and shear testing. Additionally, non-destructive seam testing will be performed over the full length of each field seam. Nondestructive testing will consist of either vacuum testing or air pressure testing. Finally, one destructive seam test will be performed per five hundred (500) feet of seam length, or one test location per seam, whichever is greater. Destructive samples will be tested in the field and QA laboratory for seam strength and peel adhesion.

Soil Materials

Soil material testing for the cap system components will consist of preconstruction testing and testing during construction. Quality control testing within these two categories will consist of material evaluation, construction quality evaluation, hydraulic conductivity evaluation and special testing. The anticipated requirements for preconstruction and construction testing are provided in Table 2-4 and Table 2-5.

2.4.5 Gas Management System

None of the materials placed in the cell will generate gas, based on the chemical composition of the S/S material and materials anticipated for disposal in the on-site cell. Readily biodegradable materials that might generate significant quantities of methane or carbon dioxide gas will not be included in the cell.. Therefore, a gas management system will not be installed.

2.4.6 Groundwater Monitoring

As part of the Removal Action Construction, a Groundwater Monitoring System shall be installed in accordance with OAC 3745-65-90 et seq. (40 CFR 265.90 et seq.) to monitor groundwater in the overburden aquifer in the vicinity of the on-site cell. In the event that it is inappropriate to monitor the overburden aquifer (as discussed in the following subsections), the Respondents anticipate that they shall apply for a groundwater monitoring waiver in accordance with OEPA RCRA regulations OAC-3745-65-90 et seq. (40 CFR 265.90 et seq.).

This section includes a description of Site hydrogeology and monitoring well location, construction, and installation techniques. It is not known at this time whether sufficient groundwater for monitoring will be encountered, and therefore, a contingency plan has been provided to deal with this potential situation.

**TABLE 2-4
PRECONSTRUCTION TESTING AND FREQUENCY REQUIREMENTS
FOR SOIL COMPONENTS OF CELL LINER AND CAP SYSTEMS**

Test	ASTM Designation	Structural Fill ^(a)	Earthen Fill ^(a)	Compacted Clay (Cap and Liner)
Classification ^(b)	D2487-90	1 per 5,000 cu yd	--	1 per 10,000 cu yd ^(c)
Compaction or Relative Density	D1557 or D4253/D4254-83	1 per 5,000 cu yd	1 per 5,000 cu yd	1 per 6,000 cu yd ⁽¹⁾
Permeability ⁽⁴⁾	D5084 or D2434	--	--	1 per 10,000 cu yd ⁽¹⁾
Moisture Content	D2216-80	--	--	1 per 5,000 cu yd ⁽¹⁾
Particle Size ⁽⁵⁾	D422-63	1 per 5,000 cu yd	1 per 5,000 cu yd	1 per 5,000 cu yd ⁽¹⁾
Atterberg Limits	D4318-84	1 per 5,000 cu yd	--	1 per 5,000 cu yd ⁽¹⁾
Shrinkage	D427-83(1990)	--	--	1 per 10,000 cu yd ⁽²⁾
Carbonate Content	D3042	--	--	--
Test	ASTM Designation	Granular Drainage Material	Coarse Aggregate ⁽¹⁾	Vegetative Layer ⁽²⁾
Classification ^(b)	D2487-90	1 per 3,000 cu yd ⁽²⁾	--	--
Compaction or Relative Density	D1557 or D4253/D4254-83	--	--	--
Permeability ⁽⁴⁾	D5064 or D2434	1 per 3,000 cu yd ⁽¹⁾	1 per 3,000 cu yd	--
Moisture Content	D2216-80	--	--	--
Particle Size ⁽⁵⁾	D422-63	1 per 3,000 cu yd ⁽¹⁾	1 per 3,000 cu yd	1 per 5,000 cu yd
Atterberg Limits	D4318-84	--	--	--
Shrinkage	D427-83(1990)	--	--	--
Carbonate Content	D3042	1 per 3,000 cu yd ⁽¹⁾	1 per 3,000 cu yd ⁽³⁾	--

⁽¹⁾ Testing protocol required by Ohio EPA.

⁽²⁾ Testing protocol recommended by engineer.

⁽³⁾ Includes perimeter toe drain and leachate collection piping system.

⁽⁴⁾ Porosity shall be reported with coefficient of permeability results.

⁽⁵⁾ Particle size per Bouyoucos Hydrometer Analysis (AASHTO T88).

⁽⁶⁾ Classification per USDA and USCS classification system.

TABLE 2-5
CONSTRUCTION TESTING AND FREQUENCY REQUIREMENTS
FOR SOIL COMPONENTS OF CELL LINER AND CAP SYSTEMS

Test	ASTM Designation	Structural Fill ⁽¹⁾	Earthen Fill ⁽²⁾	Compacted Clay (Cap and Liner) ⁽¹⁾
Field Density	D2922-81	5 per lift per acre	5 per lift per acre	5 per lift per acre
Field Moisture	D3017-88	5 per lift per acre	5 per lift per acre	5 per lift per acre
Test	ASTM Designation		Granular Drainage Material ⁽³⁾	
Field Density	D2922-81		1 per lift per 100 l.f. of trench	
Field Moisture	D3017-88		1 per lift per 100 l.f. of trench	

⁽¹⁾ Testing protocol per Ohio EPA.
⁽²⁾ Testing protocol recommended by engineer.
⁽³⁾ For pipe bedding and backfill only.

The following documents were utilized during preparation of the Groundwater Monitoring Section:

- RCRA Part B Permit Application
Standard Oil Company (Ohio) Toledo Refinery
Bowser-Morner, Inc. (1985)
- RCRA Part B Permit Application
Envirosafe Services of Ohio, Inc.
Weston (1987)
- Sampling and Analysis Plan for the Millard
Avenue Improvement Project
Bennett & Williams, Inc. (1990)

While limited on-site geologic data are available, the extensive studies of the local geology conducted on neighboring properties has allowed a detailed analysis of the site specific geologic and hydrogeologic conditions to be made.

2.4.6.1 Aquifer

The surficial deposits beneath the Commercial Oil lagoons consist of approximately 90 feet of fine-grained glacial material of low permeability, primarily silty clays. From a regional perspective, the glacial deposits covering this area constitute a major confining layer or aquiclude for the underlying bedrock aquifer because of their thickness, uniformly fine-grain size and lateral extent. Although the glacial overburden is not tapped as an aquifer in this area, small quantities of groundwater may be present either as isolated "perched" water zones trapped in laterally discontinuous, lenticular sands or sands and gravels, or at the contact between the near surface weathered and unweathered glacial clay. The perched water zones, if present, are generally found at the contact between the three glacial facies (lacustrine, upper till and lower till). However, it is possible that no near surface water bearing zone is present for groundwater monitoring.

The presence of groundwater in the surface or near surface weathered zones of these clayey deposits results from their relatively high permeabilities. Data from the Soil Conservation

Service indicates that within the A soil horizons in northwest Ohio, permeability may range from 1.43×10^{-3} to 4.3×10^{-5} cm/sec. Since the deeper unweathered clays tend to have "very restrictive permeabilities" (1×10^{-7} to 1×10^{-9} cm/sec), water which infiltrates through the weathered zone will become trapped before encountering the bedrock aquifer. Some of the water trapped between the weathered and unweathered overburden clays may therefore move laterally as base flow, eventually discharging to local creeks and/or rivers. Based on soil coloration changes noted in boring logs from the Millard Avenue Improvement Project, it was noted that the weathered zone in the glacial overburden in this area may extend between 13 to 25 feet below ground surface.

Vibra-core samples of the clay substrate beneath the Commercial Oil lagoons collected in 1989 as part of the EE/CA were, in general, relatively "fresh" or unweathered in appearance. Assuming that the bulk of the near surface, weathered overburden zone beneath the Site was excavated when the lagoons were constructed, the potential for vertical leachate migration from the Site would be eliminated. The potential for lateral movement of leachate into the lagoon side-walls would be eliminated by the construction of the engineered cell.

Silurian and Devonian Age dolomite and limestone bedrock represent the upper-most water-bearing zones used as an aquifer in the Toledo, Ohio area. Because of the relatively low primary porosity of the bedrock, groundwater movement is dominated by flow along joint planes or fractures. The fine-grained glacial overburden, which is estimated to be 90 ft. in thickness at the Site, acts as a confining layer for the bedrock aquifer. Water levels in bedrock wells surrounding the Site are all above the top of the bedrock surface, indicating the aquifer is under confining pressures. Water level data from aquifer pump tests conducted by Weston in 1985 at the EnviroSAFE landfill provide evidence that the overburden and bedrock aquifers are not in hydraulic communication. Groundwater was pumped from a bedrock production well at 350 gallons per minute for 24 hours with no measurable drawdown in observation wells in the overlying till.

Recharge to the bedrock aquifer occurs primarily in topographically higher areas about 10 miles to the south and the west of the Site where bedrock lies nearer the surface (Weston, 1987).

Vertical recharge of groundwater through the overlying confining layers is considered to be negligible, if at all, because of the extremely low permeability characteristics of the upper and lower till units.

Groundwater flow in the bedrock aquifer under the Site as documented by Weston is towards the northeast. During the summer months, pumping from production wells at the BP refinery to the northeast of the Site creates a pronounced cone of depression in the bedrock aquifer potentiometric surface, accentuating the northerly groundwater flow pattern and the hydraulic gradient.

The groundwater quality of both the glacial overburden and the bedrock aquifer have been monitored extensively at the adjoining BP refinery and Envirosafe landfill as part of the RCRA Part B permits for these facilities. Regional groundwater quality studies of this area have also been completed by the Ohio Department of Natural Resources (ODNR). As discussed in Section 3.3 of the PRP Technical Comments to the PRAP, McLaren/Hart reviewed four quarters of sampling data (1989-1990) for shallow and deep monitoring wells both upgradient and downgradient of the Commercial Oil property.

The analytical data from these sampling events did not identify any evidence of water quality problems in either the shallow (overburden) or deep (bedrock) wells. Secondary Drinking Water Standards for iron, sulfate and maganese were exceeded in several shallow wells, however this data is consistent with regional water quality studies completed by Ohio DNR. Complete summary tables of the RCRA monitoring well analytical data are provided in the PRP Technical Comments to the PRAP.

2.4.6.2 Monitoring Well Locations

At present, the placement of four monitoring wells to monitor water quality impacts in the overburden aquifer due to the engineered cell is anticipated. Monitoring well placement will occur upgradient and downgradient from the on-site cell. Exact placement will be proposed by the project hydrogeologist with considerations to current and future Site physical characteristics

and constraints (such as overhead power lines and cell configuration). Exact monitoring well locations and type will be submitted to EPA for review and approval as part of the detailed engineering submittal. The well locations currently envisioned are presented in Figure 2-10. The locations are based on a topographical review of surface elevations based on area and Site topography, as well as nearby surface water bodies.

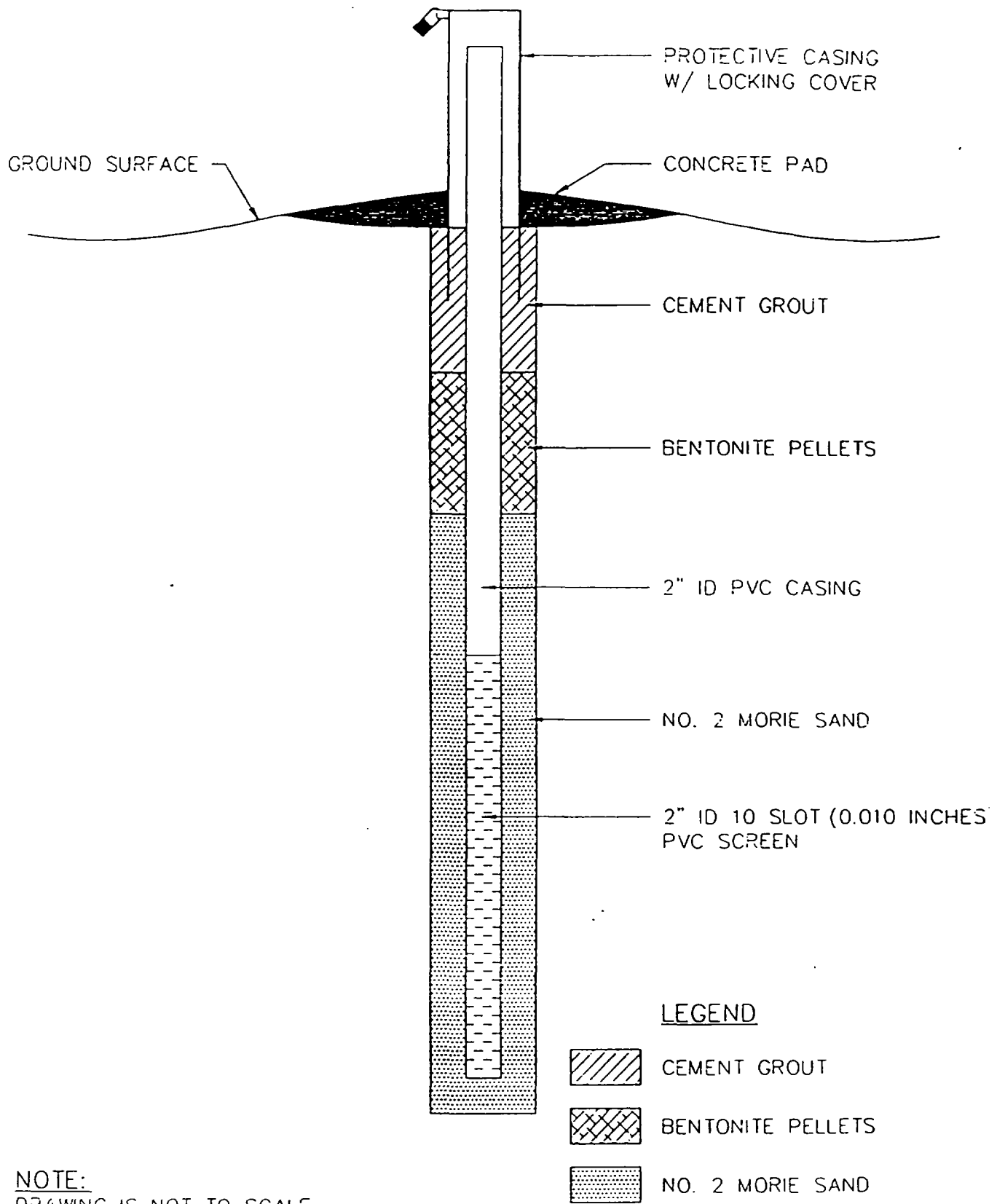
2.4.6.3 Monitoring Well Construction

This section outlines present intentions concerning monitoring well installation and construction. Some change in dimensions and specifications can be expected from the field hydrogeologist as a result of field observations. The engineer will alert EPA to significant changes to well construction specifications, with full justification in a timely manner.

Monitoring wells will be installed using hollow-stem auger drilling techniques. The auger used for well installation will have a hollow six inch inner diameter. The boring will be completed to 2 feet below the interface between "weathered" and "unweathered or fresh" clay zones. This installed depth is intended to enable monitoring of the overburden aquifer. Upon completion of well boring activities, well installation will begin. The well will be constructed of 2 inch diameter, Schedule 40 threaded coupling PVC. Screen slot size will be 0.010 inches. A general well construction diagram is presented in Figure 2-11.

2.4.6.4 Well Installation

The screened interval of the well will extend from the bottom of the well to at least two feet above the water table. Sufficient length of PVC riser will be installed to allow approximately two feet of stick-up above ground surface. The lengths of screen and riser will be measured to the nearest 0.01 foot, and recorded by the field hydrogeologist. The screen and casing will be lowered into the borehole, to the base of the boring. A sand pack will be filled in around the screen from the base of the boring to approximately two feet above the screen. The grade of filter sand used will be determined by the field hydrogeologist based on qualitative observations of soil/fill grain size. A two foot thick bentonite pellet seal will be placed on top of the sand



NOTE:
DRAWING IS NOT TO SCALE



McLAREN/HART
ENGINEERS MIDWEST, INC.

GENERIC MONITORING
WELL CONSTRUCTION

DATE: 12-3-92
APP'D: K.P.

DRAWING NO.
FIGURE 2-11

pack. The remainder of the annulus will be tremie grouted to within several feet of ground surface, using a bentonite/cement grout. A cement collar will be installed to ground surface.

To deter accidental or intentional damage to the well, a locking steel protective outer casing will be installed over the well. The well will be developed by surge pumping for at least one hour. If surge pumping cannot be maintained, the period of surging will be augmented at the direction of the field hydrogeologist.

The monitoring well will be surveyed by an Ohio licensed surveyor. Horizontal location will be determined to within 0.1 seconds latitude and longitude. Elevation of top of casing will be determined to within 0.01 feet relative to the National Geodetic Vertical Datum (NGVD). Upon completion of installation, a detailed data summary of well information will be compiled, and will include:

- Date/time of construction;
- Drilling method;
- Borehole diameter and well casing diameter;
- Well depth (± 0.01 feet);
- Drilling and lithologic logs;
- Casing material;
- Screen materials and design;
- Casing and screen joint type;
- Screen slot size/length;
- Filter pack material/size;
- Filter pack placement method;
- Sealant materials (percent bentonite, percent cement, volume water);
- Sealant placement method;
- Surface seal design/construction;
- Well development method;
- Type of protective well cap;
- Ground surface elevation (± 0.01 feet);

- Top of casing elevation (\pm 0.01 feet);
- Top of steel protective casing (\pm 0.01 feet); and
- Detailed drawing of well.

All cuttings will be placed in the engineered cell. All development water will be treated on-site. The groundwater monitoring wells will be sampled in accordance with Section 2.6.6.

2.4.6.5 Contingency Plan

There exists the potential that no significant near surface water bearing zone capable of yielding a sufficient quantity of groundwater to allow representative sampling is present at the Site. Furthermore, there exists the potential that water bearing zones, if encountered, may be localized and not connected to other water bearing zones. After monitoring well installation, the wells will be monitored monthly for water level elevation, to determine whether there is a seasonal variation, or flow direction associated with the groundwater. After one year of groundwater monitoring, if saturated conditions are not present, or the well is unable to yield sufficient quantities of water for sampling purposes, or there is no hydraulic gradient, the Respondents will apply to EPA for a waiver from groundwater monitoring in accordance with OEPA RCRA regulations for RCRA Interim Status facilities (OAC-3745-65-90 et seq.). Unless expressly modified by EPA's decision on Respondent's application for a groundwater monitoring waiver, Respondent's obligation to perform groundwater monitoring in accordance with OAC 3745-65-90 et seq. (40 CFR 265.90 et seq.) shall continue in force and effect.

2.4.7 Air Monitoring Plan

The Action Memorandum for the Removal Action at the Commercial Oil Services Site, requires air monitoring during and after the solidification/stabilization process to ensure that emissions do not exceed a cumulative cancer risk of 10^{-6} and do not exceed any ARARs. The objective of the air monitoring plan for this Site is to assess the ambient air impact from the removal action emissions for comparison with established cancer risk levels and ARARs.

The Air Monitoring Plan, which will be developed during Removal Action Design, will identify the EPA procedures for air pathway analysis as described in part in the National Technical Guidance Study (NTGS) four-volume set¹. The air contaminants measured under the air pathway analysis will be used for evaluating risks at the Site as described in the Ohio EPA Final Draft Guidance Manual "Review of New Sources of Air Toxic Emissions" (February 1992). The Air Monitoring Plan will highlight the work necessary to: obtain data on physical site conditions; conduct preliminary site measurements; establish analyses with data quality objectives; and schedule. These steps are required to characterize the air emissions during the S/S process, and allow for computation of the cumulative cancer risk.

The results from the treatability study conducted at the Site estimated that potential uncontrolled emissions from the Site during the S/S operation would result in approximately 91 tons of VOCs regulated under the Clean Air Act for Mix 3. Approximately 80% of the estimated emissions are represented by trichloroethene, toluene, 1,2-dichloroethene, and xylene isomers.

While the projected air emissions from the S/S treatment process are low, several steps in the process are potential sources of volatile and particulate air emissions. The in-vessel S/S process will employ an air emissions collection and treatment system to effectively manage particulate and volatile emissions from this process. Other potential sources of emissions during removal action construction are the dredging and screening operation, untreated and treated material storage, treated material handling, and reagent handling.

2.4.7.1 Previous Air Modeling

Air modeling was previously conducted to determine whether the uncontrolled release of volatiles during Site S/S operations would pose a threat to public health. A position paper dated June 2, 1992 on Volatile Air Emissions during Sludge Solidification/Stabilization at the Commercial Oil Services Site was prepared by McLaren/Hart. This paper included calculations

¹U.S. Environmental Protection Agency. Volumes I, II, III and IV - National Technical Guidance Series - Procedures for Conduction Air Pathway Analyses for Superfund Applications. EPA-450/1-89-001, -002a, -003, -004.

for a volatile mass balance and associated air emissions, and included air quality modeling without emission controls. The air model indicated the maximum impacts to which the public would be exposed occur at the north fence line by Cedar Point Road (Receptor 1). Ground level concentrations were also determined for the nearest residential area (Receptor 2), which is 0.8 miles east of the Site.

A comparison of these previous model results with the draft Ohio EPA air quality guidelines indicated that the guidelines might be exceeded at Receptor 1 for vinyl chloride, trichloroethene, toluene, and xylenes. These guidelines were not exceeded at Receptor 2. Based upon a screening level risk assessment of the 15 VOCs identified in the lagoons and the associated air modeling results, the VOC concentrations produced during Site remediation activities will not pose a significant threat to public health. Therefore, based on the previous work, even without air pollution controls, Site S/S activities would not exceed draft Ohio EPA guidelines for the nearest residential area, or pose a risk to the public.

2.4.7.2 Air Monitoring

An air monitoring system will be used to determine the ambient air impacts from emissions resulting from the excavation and handling of lagoon sludge. Lagoon No. 7, which will be the first lagoon excavated and treated, contains approximately 67 percent of the volatiles at the Site. During the excavation of Lagoon No. 7, three sampling events will be conducted using the upwind/downwind technique. Sources such as the dredging and screening area, and the S/S treated material storage area and handling area will be considered combined emission sources. For the combined sources, sampling/analyses will be performed using the EPA T01 and/or T02 methods from the Compendium of Methods for the Determination of Organic Toxic Compounds in Ambient Air.

By sampling during the initial excavation/treatment of Lagoon No. 7, the maximum impacts of this phase of the S/S process will be assessed. Under this approach, one sampler will be located upwind of the Site and a series of samplers will be located downwind. The sampling stations will include calibrated sampling pumps and sorbent tubes for VOCs. It is expected that two to

three samplers will provide sufficient downwind coverage. Owing to Site constraints, upwind and downwind locations may likely be at the Site fenceline.

The air monitoring network will also include a weather station for measuring wind speed and direction. Meteorological monitoring will be performed to properly align the sampling systems and to analyze the data following sample analysis. The monitoring plan will be documented in the Construction Work Plan SAMP.

In addition to, and independent from the ambient sampling described above, the point source emissions from the S/S process vessel air pollution control system will be assessed using EPA stack testing procedures. The stack emissions will be measured using the following EPA Reference Methods from Appendix A of 40 CFR 60: Method 5 for particulates; Method 18 for VOCs; and Method 26 for hydrogen chloride. The testing procedure will include three test runs on the stack to quantify emission rates.

Dispersion modeling similar to that described in Section 2.4.7.1 will be used to assess ambient air impacts from the combined S/S process stack and fugitive emissions. The upwind/downwind emission monitoring and the stack emission data will be used to determine ambient air impacts using dispersion modeling techniques. Modeling is necessary to account for the different emission source locations, and buoyancy effects of the stack emission.

2.4.8 Residuals Disposal

This section addresses the disposal of various items not addressed elsewhere. All residual streams that will be transported and disposed of off-site, will be disposed of or treated at a facility approved by the On-Scene Coordinator and in accordance with the Resource Conservation and Recovery Act of 1976 (RCRA), 42 U.S.C. Section 6901, et seq., as amended, the EPA Off-Site Policy (OSWER Directive 9834.11, November 13, 1987 and subsequent revisions thereof, SARA Section 121(d)(3), the Toxic Substances Control Act (TSCA) PCB requirements under 40 CFR 761, and all other applicable current Federal, State and local requirements. Table 2-6 lists various residuals and their planned disposal.

**TABLE 2-6
RESIDUALS DISPOSAL**

Item	Description	Disposal
PPE	Personal Protective Equipment	On-site disposal
Miscellaneous Contaminated	Construction materials impacted by site wastes	On-site disposal ⁽¹⁾
Trash	Office waste, packing materials, etc.	Off-site disposal
Sanitary Waste	--	Off-site disposal ⁽²⁾
Decon Water	Generated from decontamination activities	On-site treatment ⁽³⁾
Wet Electrostatic Precipitator Sludge	Generated from S/S APC process equipment	On-site reuse ⁽⁴⁾
Salt Laden Blowdown	Generated from scrubber in APC unit	On-site water treatment system
Treatment System Sludge	Generated from the water treatment system	On-site S/S and disposal
Spent Oil Absorbent	Generated from the water treatment system	On-site S/S and disposal
Spent Carbon	Generated from the water treatment system	Off-site regeneration

⁽¹⁾ On-site disposal will not be used for any item identified as "F-listed" waste.
⁽²⁾ To sanitary sewer if sewer hookup is available, otherwise "Porta-John" contractor.
⁽³⁾ Decon waters generated subsequent to water treatment system operation will be disposed off-site.
⁽⁴⁾ Wet electrostatic precipitator sludge will be reused in the S/S Process.

2.4.9 Waterfowl Deterrence System Maintenance

This section has been developed to address routine maintenance of the waterfowl deterrence system until construction activities render maintenance of the system unnecessary. The principal maintenance activities will be as follows:

- Periodic inspections of the existing system; and
- Appropriate repairs as necessary to maintain the current effectiveness of the existing system.

Inspection of the existing system will be performed on a weekly frequency until construction activities render maintenance of the system unnecessary. After each weekly inspection, the completed inspection record will be reviewed and submitted to EPA with the monthly progress report.

In the event a deficiency is observed during the inspection, or at any other time, the deficiency will be promptly corrected as appropriate.

2.5 SITE WORK

This section describes Site improvements to be made as part of the Removal Action.

2.5.1 Stormwater and Erosion and Sediment Control

Stormwater management features typically consist of stormwater diversion channels, culverts, sedimentation basins and stilling basins. In order to address any design issues associated with stormwater and erosion and sediment control, the document titled, "Water Management and Sediment Control for Urbanizing Areas" prepared by U.S. Department of Agriculture, Soil Conservation Service will be referenced.

Due to the existing physical constraints at the Site, it appears that design of a sedimentation basin is not feasible. This is based upon a review of the existing site topography. No surface water features exist within the property boundaries. One intermittent drainage swale exists along the eastern edge of the property and slopes in a south to north direction. Based on an evaluation of existing conditions at the Site, the design engineer will attempt to specify silt fence and hay bales to the maximum extent possible to control erosion and sediment transport. Also, the design engineer will attempt to design the final grades to promote stormwater drainage to a single point source.

2.5.2 Fencing/Site Security

Presently, the Site is surrounded by a six feet high chain-link fence. The design engineer will evaluate the location of the fence with respect to proposed design features to determine if relocation of fencing is required. The design engineer will also make recommendations to upgrade the Site security system as needed.

2.5.3 Site Access/Maintenance Roads

Following completion of the closure design, site access roads (main roads) and maintenance roads (secondary roads) will be developed for the facility. Both the access and maintenance roads will be designed for all weather usage. The access roads will be designed to a width of 20 feet and the maintenance roads will be designed to a width of 12 feet.

2.5.4 Utilities

The design engineer will coordinate a meeting with the applicable utility companies to assess the impact that the design may have on existing utilities, including overhead power lines, water lines, sewer lines, stormwater culverts, etc.

2.5.5 Landscaping

Subsequent to Site grading and topsoil placement, the cap and non-cell areas will be seeded to establish appropriate vegetation on the Site. The cap will be seeded and maintained in accordance with the Operation & Maintenance Plan outline in Section 3.2.5. Non-cell areas will be seeded in accordance to the Site Sediment Erosion and Control Plan. It is anticipated that landscaping activities will also include the limited planting of trees in non-cell areas to enhance the overall aesthetics of the Site.

2.6 OPERATION & MAINTENANCE PLAN

An Operation and Maintenance (O&M) Plan will be prepared as part of the design effort. Information discussed in the O&M Plan will include: Containment Cell Operation, Environmental Monitoring, Leachate Management, Closure, and reporting. A brief outline of the items to be included under each topic is provided below:

2.6.1 Containment Cell/Sludge Handling Operations

- Staging of construction;
- Description of material solidification/stabilization;
- Description of waste handling and placement;
- Description of overall cell development;
- Development of access roads;
- Development of borrow resources/stockpiles; and
- Operation of erosion and sediment control features.

2.6.2 Environmental Monitoring

- Surface water monitoring;
- Groundwater monitoring (see Section 2.6.6); and
- Leachate monitoring.

2.6.3 Leachate Management

- Leachate system operation and maintenance;
- Leachate volume measurement; and
- Leachate disposal.

2.6.4 Closure

- Description of the steps necessary for closure;
- Final cap maintenance and revegetation; and
- General site inspection/maintenance procedures.

2.6.5 Reporting

- Results of construction activities;
- General procedures for reporting and recordkeeping;
- Results of site inspections/maintenance; and
- Results of environmental monitoring.

2.6.6 Groundwater Monitoring

Groundwater monitoring will be conducted in accordance with OAC 3745-65-90 et seq. (40 CFR 265.90 et seq.) for up to 30 years as part of Site O&M. After five years, a report will be prepared to evaluate the necessity of further groundwater monitoring. Each well will be monitored for the RCRA parameters establishing groundwater quality and as indicators of groundwater contamination (40 CFR 265.92), as follows:

Parameters establishing groundwater quality

Chloride
Iron
Manganese
Phenols
Sodium
Sulfate

Parameters used as indicators of groundwater contamination

pH
Specific Conductance
Total Organic Carbon
Total Organic Halogen

Other

Groundwater Elevation

Sampling for the listed parameters to establish groundwater quality will be performed quarterly for one year, and annually thereafter. Sampling for the listed parameters to indicate groundwater contamination will be performed quarterly for one year and semi-annually thereafter. Elevation of the groundwater surface at each monitoring well will be determined during each sampling event.

In addition to the above listed groundwater monitoring, the parameters characterizing the suitability of drinking water will be monitored (Appendix III of OAC 3745-65-92, 40 CFR 265.92). Monitoring will consist of quarterly sampling for one year of the following parameters:

Arsenic	Lindane
Barium	Methoxychlor
Cadmium	Endrin
Chromium	Toxaphene
Fluoride	2,4-D
Lead	2,4,5-TP Silvex
Mercury	Radium
Nitrate (as N)	Gross Alpha
Selenium	Gross Beta
Silver	Coliform Bacteria

A Groundwater Monitoring Plan will be developed as part of the O&M Plan (see Section 3.2.5). The Groundwater Monitoring Plan will discuss whether further groundwater monitoring will be necessary after five years.

2.7 SUMMARY OF REMOVAL ACTION PERFORMANCE STANDARDS

This section summarizes the various performance standards that shall be achieved in implementation of the Removal Action at the Commercial Oil Services Site.

NPDES Standards for Treated Water Discharge

As part of the lagoon closure activities, impounded water will be treated in an on-site water treatment system. The treated effluent will meet the discharge standards established by OEPA in accordance with applicable regulations as follows:

Parameter	Effluent Criteria
Oil & Grease, mg/l	10
NH ₃ -N, mg/l	1.5
TSS, mg/l	30
Total Phenols, ug/l	10
pH, std units	6.5-9
Chromium, ug/l	54
Copper, ug/l	23
Lead, ug/l	30
Benzene, ug/l	5
Ethyl Benzene, ug/l	142
Trans 1,2-dichloroethene, ug/l	5
1,1,1 Trichloroethane	88
Toluene, ug/l	2
Total Xylenes, ug/l	440
PCB (total), ug/l	Non-detect

PCB Wipe Test Standard

During the Removal Action, the following structures will be wipe tested for PCBs per 40 CFR 761.130 prior to disposal.

- Boiler from the tank farm boiler house and associated piping;
- Boiler in the garage and associated piping; and
- Above ground tanks and debris that are found to contain PCBs greater than 25 ppm.

Decontamination of these structures will achieve a clean-up level of 10 ug/100cm² of PCB prior to disposal.

Soil Clean-up Standards

Soil clean-up standards for indicator parameters will be based on background levels or risk assessment derived clean-up levels. The calculation of background contaminant levels as well as risk based levels will be in accordance with the Ohio EPA document titled, "How Clean is Clean Policy" dated July 26, 1991, for all areas of the Site not regulated under RCRA. For RCRA areas (Lagoon Nos. 1, 2, 6 and 7 and the Tank Farm), closure will be in accordance with levels calculated in accordance with OEPA hazardous waste regulations OAC 3745-66-11, OAC 3745-66-97 and OAC 3745-67-28 (40 CFR 265.111; 40 CFR 265.197 and 40 CFR 265.228).

Component Thickness for Liner Materials

The engineered cell shall be constructed to meet the requirements of 40 CFR 761.75. The low permeability soil liner will consist of a minimum four feet of low permeability soil (permeability of less than or equal to 1×10^{-7} cm/sec). If sand or gravel stringers are encountered within the subbase, the sand or gravel will be removed up to a depth of four (4) feet and replaced with low permeability soil, as necessary to complete the liner.

Component Thickness for Cap Materials

A multi-layered cap system will be placed above the engineered cell. The cap system shall meet the requirements of 40 CFR Section 265.310 and the standards described in the document titled, "Final Covers on Hazardous Waste Landfills and Sludge Impoundments." The cap will consist of the following components (in descending order):

- Six inches of topsoil (vegetative layer);
- 18 inches of earthen fill material;
- Geotextile layer (fabric weight will be approximately 6 oz/yd²);
- 18 inches of granular drainage material (100% of the selected material will pass a 3/4 inch sieve);
- Synthetic geomembrane (40 mil HDPE or VLDPE layer); and
- 24 inches of compacted low permeability soil (permeability of 1×10^{-7} cm/sec or less).

Underground Fuel Tank Closure

Closure of the fuel tanks will be conducted in conformance with OAC Rule 1301:7-9-12, as follows:

Constituent	Clean-Up Goals (mg/kg)
Soil BTEX	0.50/12/18/85
Soil TPH (Gasoline)	600
Soil TPH (Others)	1156

Solidification/Stabilization Operation

The performance standards for the sludge S/S operation, which shall be demonstrated during the System Performance Test, are as follows:

- Pass TCLP parameters on treated material;
- Achieve a bearing capacity of 1.5 tons per square feet on S/S treated material to assure cap constructability and long-term stability; and
- Capture and treat organic vapors and dust in the off-gases from the in-vessel S/S treatment unit.

During full-scale S/S operation, both reagents and materials feed rate will be controlled by using volumetric feeders which will be factory calibrated. S/S process control monitoring will consist of paint filter test, bearing capacity test and reactor/dryer temperature.

Groundwater Monitoring System

A groundwater monitoring system shall be installed in accordance with OAC-3745-65-90 et seq. (40 CFR 265.90 et seq.), subject to EPA's potential evaluation of a groundwater monitoring waiver.

Air Pollution Control System

The Air Pollution Control (APC) system shall be capable of capturing and controlling the following:

- Particulate and associated adsorbered/absorbered contaminants;
- Organic compounds; and
- Acid gas resulting from chlorinated hydrocarbon destruction.

The efficiency of the APC system will be determined during the S/S System Performance Test. Process control variables determined during this test will be utilized to ensure performance of the APC System during full-scale operation. Three rounds of APC stack emission testing will be conducted during the treatment of Lagoon No. 7 material. The stack emissions will be measured using the following EPA Reference Methods from Appendix A of 40 CFR 60: Method 5 for particulates, Method 18 for VOCs, and Method 26 for hydrogen chloride.

Air Quality Standard

An air monitoring system will be used to measure the ambient air impacts from emissions resulting from the excavation and handling of lagoon sludge. Three air monitoring events utilizing the upwind/downwind technique will be conducted during Lagoon No. 7 S/S operations. Sampling and analyses will be performed using the EPA T01 and/or T02 methods from the Compendium of Methods for the Determination of Organic Toxic Compounds in Ambient Air.

These results, along with the point source emissions from the APC unit, will be input into a dispersion model. Model output will be used to demonstrate a cumulative cancer risk of less than 10^{-6} from total site emissions.

3.0 REMOVAL ACTION DESIGN

This section discusses the specifics of what will be included in each design submittal. For details regarding the removal action, the reader is referred to Section 2. It should be noted that the Removal Action will consist of two separate actions, the first action will include the Tank Farm Closure, and above ground and below ground tanks. The remaining elements (lagoon closure, site work and O&M) will be a separate action. As such, two separate sets of design submittals shall be prepared by Respondents and submitted to EPA for review and approval. These two actions are necessary in order to sequence the work, and, to allow the less difficult closure elements to proceed through design and construction first.

3.1 DESIGN REPORTS

Two design reports, a 30% submittal (Preliminary Design Report) and a 100% design submittal (Final Design Report) shall be submitted to EPA for review and approval. The specifics of each report are delineated in the following sections.

3.1.1 Preliminary Design Report

The Preliminary Design Report will include a description and analysis of various design options for the on-site engineered cell. The Preliminary Design Report will recommend a preferred conceptual design based on the issues discussed in Section 2. The design analysis will provide the rationale for recommending a preferred conceptual design, including supporting calculations and documentation of how such design will meet the requirements of the Order. The design report shall include the following items:

- (1) A discussion of the design criteria and objectives, with emphasis on the capacity and the ability to successfully meet design objectives. The preliminary design will include a value engineering analysis. The purpose of value engineering is to determine the most cost-effective means for achieving the design objective. During value engineering, issues such as the final configuration of the leachate

collection system and cap will be considered. The preliminary design report will also include a detailed evaluation of the cap component alternatives evaluation, and potential availability of on-site/off-site borrow material.

- (2) Table of Contents for design specifications, including a listing of specification items from the Construction Specifications Institute master format expected to be included in the construction specifications or the actual specifications.
- (3) Site security measures.
- (4) Site safety and emergency measures.
- (5) Preliminary plan view(s) for Site preparation and layout.
- (6) Preliminary plans and profiles illustrating areas to be excavated.
- (7) Plans for collection and conveyance of excavated materials.
- (8) Preliminary construction material recommendations.
- (9) Preliminary construction drawings of standard size, will include proposed work, facilities, equipment, improvements, details and all other construction and installation items as well as drawings representing an accurate identification of existing Site conditions. More specifically, these drawings will include:
 - Title sheet bearing at least the title of the project, a key map, the name of the designer, date prepared, sheet index, EPA project identification, etc.
 - All property data including owners of record for all properties within 200 feet of the Site.

- The distance and bearing of all property lines which identify and define the project Site.
- All easements, rights-of-way and reservations.
- All buildings, structures, facilities, controls, equipment and features, existing and proposed.
- A topographic survey, including existing and proposed contours and spot elevations, based on U.S. Geological Service datum.
- All utilities, existing and proposed.
- Location and identification of all significant natural features including, but not limited to, wooded areas, water courses, flood hazard areas and depressions.
- Flood hazard data and delineation, if applicable.
- North arrow, scale, sheet numbers and the person responsible for preparing each sheet.
- Decontamination areas, staging areas, and stockpiling areas.
- Stormwater drainage/diversion ditch system and stormwater detention system details, as needed.
- Miscellaneous detail sheets.
- Definitions of all symbols and abbreviations.

3.1.2 Final Design Report

The Final Design Report will include the plans and specifications which have been completed, together with a design analysis. The design analysis will provide the rationale for the plans and specifications, including supporting calculations and documentation of how these plans and specifications will meet the requirements of the Order. The design report will also include the following items:

- (1) Final analysis of the design criteria and objectives, with emphasis on the capacity and the ability to successfully meet design objectives.
- (2) Completed Design Specifications.
- (3) Site security measures.
- (4) Site safety and emergency measures.
- (5) Plan view(s) for Site preparation and layout.
- (6) Plans and profiles illustrating areas to be excavated.
- (7) Plans for collection and conveyance of excavated materials.
- (8) Construction Drawings.
- (9) Construction material recommendations.

The Final Design Report will also include: Construction drawings of standard size of the proposed work, facilities, equipment, improvements, details and all other construction and installation items as well as drawings representing an accurate identification of existing Site

conditions. Increased levels of detail will be incorporated with final design reports corresponding to the percent completion of the engineering design and specification of materials.

3.2 CONSTRUCTION WORK PLAN

The Final Design Report will include a Construction Work Plan which will be developed for the construction phase of work. The following subsections present detailed descriptions for the items to be included in the Construction Work Plan.

3.2.1 Sampling, Analysis and Monitoring Plan for Construction

A SAMP will be prepared for the sampling, analysis, testing and monitoring activities that will be conducted during the construction phase work. The SAMP for the construction phase will discuss procedures for sample collection, locations of sampling points and the rationale for their selection, analytical parameters, frequency of sampling, and quality assurance/quality control procedures.

The construction-phase SAMP will prescribe field sampling methods selected from the appropriate EPA Field Sampling Procedures Manual. Sampling procedures which differ from those specified in the EPA manual will be fully documented and referenced to established methods or procedures.

The construction-phase SAMP will describe the testing of construction materials prior to use, and testing of constructed components to assure that they meet design specifications.

The SAMP for construction-phase environmental monitoring activities will specify that sample analyses be performed according to EPA Contract Laboratory Program (CLP)² protocol's

²CLP methods are those contained in the "USEPA Contract Laboratory Program Statement of Work, Inorganic Analysis" (revised 12/87), "USEPA Contract Laboratory Program Statement of Work for Organic Analysis," (Feb. 88), and "USEPA Contract Laboratory Program Statement of Work for Dioxin Analysis," (Sept. 86).

(where appropriate and applicable), or with methods described in Test Methods for Evaluation Solid Wastes.³ The SAMP will also specify that data deliverables for analyses performed according to CLP protocols be submitted according to CLP criteria and format. For analyses performed according to non-CLP methodologies, the SAMP for construction activities will require that data deliverables be in a format similar to CLP format, if appropriate. The SAMP will include an example of the non-CLP deliverable format.

A major element of the construction-phase SAMP will be a Quality Assurance Project Plan (QAPjP) to address quality assurance requirements and standards relating to construction operations. These requirements and standards may include (but are not limited to) construction of the staging area and access roads. Quality assurance factors that will be addressed include:

- inspection of the work;
- daily construction logs and reports;
- preparation of as-built drawings;
- testing of the work to establish whether the design specifications are attained; and
- plans for photographic documentation of the construction.

In addition to construction quality assurance, the QAPjP will cover all environmental monitoring performed during the construction phase. These monitoring aspects of the QAPjP will be in accordance with the EPA Quality Assurance Manual. At a minimum, the QAPjP for the construction phase will include:

- title page and table of contents;
- project description;
- project organization and responsibility;
- quality assurance objectives;
- sample custody procedures;
- calibration procedure and frequency;

³SW-846, 3rd Edition, November 1986.

- analytical procedures;
- procedures for data reduction, validation and reporting;
- internal quality control checks;
- performance and system audits;
- preventive maintenance;
- specific routine procedures for assessing data precision, accuracy and completeness;
- corrective action; and
- QA reports to management.

The SAMP will further specify that sample custody procedures be in conformance with EPA chain-of-custody protocols as described in National Enforcement Investigations Center Policies and Procedures Manual, (revised May 1986).

3.2.2 Health and Safety Requirements for Construction

As part of the Construction Work Plan, specific HASP requirements governing all on-site construction activities will be prepared. These requirements will be in the form of detailed specifications for preparation and implementation of the HASP, rather than as a formal HASP.

This approach is necessary because the construction-phase HASP will be equipment/personnel/contractor and technology specific, and this high degree of specificity cannot be taken into account during the design phase. It is likely that prospective construction contractors will submit draft versions of the construction-phase HASP as part of their bid submittals. Final versions of the construction phase HASP will be prepared after contract award and prior to initiating construction activities.

Preparation of the construction-phase HASP specifications will be initiated through a review of the available project information including HASPs from previous phases of work at the Site (EE/CA HASP, Water Treatment HASP, Treatability Study HASP). After this review, detailed specifications will be prepared. The construction contractor will then prepare a final HASP for

the construction period. The HASP specifications will include the minimum health, safety and emergency response requirements for which the construction contractor will be made responsible, and which must be included in the final HASP developed by the construction contractor.

The draft HASP specifications will be prepared with consideration of applicable Federal and State regulations and guidance. Reference documents that may be reviewed (or cited as references in the specifications) include:

- CERCLA sections 104(f) and 111(c)(6);
- EPA Order 1440.1 - Respiratory Protection;
- EPA Health and Safety Audit Guidelines - SARA Title 1 - Section 126
- EPA Occupational Health and Safety Manual;
- EPA Interim Standard Operating Safety Guide;
- OSHA Standards for General Industry (29 CFR 1910);
- NIOSH Manual of Analytical Methods;
- ANSI 288.2-1980: Practices for Respiratory Protection;
- Latest edition of ACGIH TLVs; and
- ACGIH - Air Sampling Instruments for Evaluation of Atmospheric Contaminants.

The construction-phase HASP prepared by the construction contractor will include, at a minimum, the following items:

- plans showing the location and layout of temporary facilities (i.e., decontamination pads, trailers, etc.) to be constructed;
- description of known hazards and an evaluation of the risks associated with the Site and the potential health impacts related to the construction activities;
- identification of personnel responsible for site safety, response operations and communication;

- description of the levels of protection and the respective equipment to be utilized;
- delineation of work zones, procedures for movement between zones and a map showing the work zones;
- description of decontamination procedures;
- incident emergency response and personnel evacuation procedures;
- description of the medical surveillance program;
- description of site safety monitoring procedures;
- routine and special personnel training programs; and
- air monitoring program to determine the concentrations of airborne hazardous substances to which on-site workers and persons in the vicinity of the site may be exposed.

The construction HASP will incorporate all the provisions as found within 29 CFR 1910.120, which by reference, include all provisions contained within 29 CFR 1910, General Industry Standards, and 29 CFR 1926, Construction Standards. Safety guidelines for heavy equipment operation should be a major consideration for this HASP.

The construction-phase HASP specifications will be submitted to EPA as part of the Construction Work Plan.

3.2.3 Construction Operations Plan

The Respondents will prepare a Construction Operations Plan which will address the methods by which construction activities will be executed. This discussion will include the timing of, and

manner in which construction activities will be sequenced. The Construction Operations Plan will be incorporated into the final bidding documents as part of the technical specifications to which the successful contractor will be bound.

Preparation of the Construction Operations Plan will include a number of separate components. The first component will be detailed requirements for preparation of the Site including:

- provision of utility services;
- storage of construction equipment;
- construction of decontamination facilities;
- set-up of construction and office trailers; and
- other site work.

The sequence for executing these preparatory activities and the rationale for that sequence will also be defined in the Construction Operations Plan.

The second component of the Construction Operations Plan will be sequencing and coordination of construction activities. This plan is critical owing to the complex sequencing required to ensure timely completion of the removal action.

The Construction Operations Plan will detail the plans and procedures for coordinating with local authorities regarding contingency planning. Local authorities could conceivably be called upon to institute evacuation or public notifications, and to provide emergency services (fire, ambulance, police, etc.). The Construction Operations Plan will describe the responsibilities of the various authorities, points-of-contact, criteria for determining when local resources will be contacted, and procedures for transferring responsibility for Site control.

The Construction Operation Plan will also detail the plans and procedures for dust control and erosion control.

3.2.4 Construction Schedule

The Respondents will prepare a detailed schedule for the construction work. The final schedule for construction will be prepared after the Construction Operations Plan has been completed. This sequence will be followed because the Construction Operations Plan will include details regarding sequencing of the site activities, that will define durations of those activities. The construction schedule will be submitted to EPA as part of the Construction Work Plan.

3.2.5 Operation and Maintenance Plan

As a part of the Construction Work Plan, an Operation and Maintenance Plan for the O&M phase of the work will be prepared. The O&M phase will start when the construction work is complete. The O&M Plan will cover all items identified in Section 2.6.

At a minimum, the O&M Plan will include the following major components:

- a Sampling, Analysis and Monitoring Plan (SAMP);
- a Health and Safety Plan (HASP); and
- an O&M schedule.

Details regarding each of the major components of the O&M Plan are discussed below.

3.2.5.1 Sampling, Analysis and Monitoring Plan

The first major component of the O&M Plan will be a SAMP covering relevant O&M activities. The SAMP for the O&M phase will discuss procedures for sample collection, locations of sampling points and the rationale for their selection, analytical parameters, frequency of sampling and quality assurance/quality control procedures.

The SAMP will prescribe field sampling methods selected from the Procedures Manual. Sampling procedures which differ from those specified in the EPA manual will be fully documented and referenced to established methods or procedures.

The SAMP for O&M activities will specify that sample analyses be performed according to EPA Contract Laboratory Program (CLP)⁴ protocols (where appropriate and applicable), or with methods described in Test Methods for Evaluating Solid Wastes.⁵ The SAMP will also specify that data deliverables for analyses performed according to CLP protocols be submitted according to CLP criteria and format, if appropriate. For analyses performed according to non-CLP methodologies, the SAMP for O&M activities will require that data deliverables be in a format similar to CLP format. The SAMP for O&M activities will include an example of the non-CLP deliverable format.

Other elements of the SAMP for O&M activities will include:

- maps or figures illustrating proposed sampling locations; and
- a Quality Assurance Project Plan for O&M Activities (QAPjP for O&M) completed in accordance with the requirements of the EPA CERCLA Quality Assurance Manual.

The SAMP for O&M activities will include all of the elements described in Section 3.2.1.

⁴CLP methods are those methods contained in "USEPA Contract Laboratory Program Statement of Work, Inorganic Analysis," (revised 12/87), "USEPA Contract Laboratory Program Statement of Work for Organic Analysis," (Feb. 88), and "USEPA Contract Laboratory Program Statement of Work for Dioxin Analysis," (Sept. 86).

⁵SW-846, 3rd Edition, November 1986.

3.2.5.2 Health and Safety Plan

A HASP for O&M activities will be prepared to ensure the safety and protection of health for workers participating in the O&M activities. The HASP for O&M activities will include all of the elements described in Section 3.2.2.

3.2.5.3 Operation and Maintenance Schedule

The O&M Plan will include a detailed schedule for all O&M activities associated with the O&M phase of work. The O&M schedule will be prepared as described in Section 3.2.6 and 4.3, and will be included in the O&M Plan.

3.2.6 Schedule for O&M Activities

The Respondents will also prepare a detailed schedule for the operation and maintenance activities. This O&M schedule will include all of the post-design phase operation and maintenance activities that will be performed.

The final O&M schedule will be prepared after the Construction Operations Plan and Operation & Maintenance Plan have been completed. This sequence will be followed because these plans will define the O&M tasks to be performed, as well as the frequency and duration of those tasks. The O&M schedule will be submitted to EPA as part of the Construction Work Plan.

3.2.7 Plans for Photographic Documentation of the Construction

As part of the Construction QAPjP, the Respondents will develop written plans and procedures for photographic documentation of the construction work. These plans will be implemented by the contractor selected for oversight and inspection of the construction activities.

The plans for photographic documentation will be based upon the sequencing of construction activities as discussed in the Construction Operations Plan (see Section 3.2.3). A schedule of

planned documentation including number of still shots, number of prints, sizes of prints and other relevant information will be prepared for each phase of the construction work. These plans will also describe the procedures to be followed for labelling construction photos with (but not limited to) the following information:

- date and time of exposure;
- name of photographer; and
- description of photograph.

The plans for photographic documentation may also include the use of video recording. If so, the Respondents will prepare a schedule of events or activities that will be videotaped and the desired footage of each event or activity. The documentation plans will specify procedures for cataloging, labelling, duplication and storage of videotapes.

The Respondents will furnish copies of the photographic documentation to EPA. Photographs will be provided so as to record the progress of construction including, but not limited to, the important features of the Site prior to the commencement of the work, construction activities for the various tasks, and the appearance of the Site after the construction has been completed. These photographs will be developed expeditiously, and will be submitted to EPA as part of the final report.

3.2.8 Site Security Plan

As a part of the Construction Work Plan, a Site Security Plan will be developed to address routine security measures of the Site during the construction and post-construction periods.

The principal security activities during the construction and post-construction phases will be:

- periodic inspection of (and necessary repairs to) the Site security systems; and
- periodic inspection of the Site monitoring system.

3.2.9 Fire Protection and Prevention Plan

A Fire Protection and Prevention Plan will be prepared during the development of the Construction Work Plan. This plan will be prepared to control and prevent fires/explosions which may occur during the construction and post-construction periods. This plan will be also prepared to provide response procedures to be followed by Site personnel during a fire/explosion emergency.

4.0 PROJECT SCHEDULES

4.1 REMOVAL ACTION DESIGN

Table 4-1 sets forth the schedule for design activities for the Response Action.

4.2 SCHEDULE FOR CONSTRUCTION

A schedule for the construction activities is also presented in Table 4-1. The final schedule for construction will be submitted to EPA as part of the Construction Work Plan reports (see Section 3.2.4). It should be noted that two separate construction activities are planned, namely Tank Farm Closure and Lagoon Closure. The schedule presented in Table 4-1 is significantly longer than the construction schedule envisioned in the EE/CA. This increase in time is due to the necessity to procure, fabricate and construct the in-vessel material S/S facility, including off-gas control.

4.3 SCHEDULE FOR O&M ACTIVITIES

Site O&M activities consist primarily of leachate collection maintenance, cap maintenance, and groundwater monitoring. Site O&M activities will commence upon completion of Removal Action construction and continue for up to 30 years. A detailed schedule for O&M activities will be prepared as part of the final design submittal for Lagoon Closure (see Section 3.2.6).

TABLE 4-1 REMOVAL SCHEDULE	
Activity	Time Frame
A. Tank Farm Closure	
1. Preliminary Design	5 weeks after EPA approval of the Phase II Work Plan
2. Final Design	6 weeks after EPA approval of the Preliminary Design
3. Construction	Initiate construction 10 weeks after EPA approval of Final Design. Complete construction in accordance with schedule in approved Final Design.
B. Lagoon Closure	
1. Preliminary Design	8 weeks after EPA approval of the Phase II Work Plan
2. Final Design	13 weeks after EPA's approval of the Preliminary Design
3. Construction	Initiate construction 14 weeks after EPA approval of Final Design. Complete construction in accordance with schedule in approved Final Design.

5.0 REMOVAL ACTION CONSTRUCTION

The Removal Action Construction will be completed as described in Section 2.0, Detailed Description of Removal Action, of this Work Plan. The Removal Action Construction will be completed in accordance with the specifications and procedures described in Section 3.0, Removal Action Design, of this Plan.

The schedule for Removal Action Construction will adhere to schedules described in Section 4.0, Project Schedules, of this report.

6.0 FINAL REPORT

Following completion of the Removal Action, the contractor will prepare a Final Report. This report will also serve as notification of Removal Action Construction completion to governing agencies (i.e., EPA) and, at a minimum, will include the following:

- identification of the Site;
- a description of the locations and types of hazardous substances encountered at the facility;
- a chronology and description of the actions performed;
- a listing of the resources committed to perform the work under the Consent Order;
- identification of all items that affected the actions performed under the Consent Order and discussion of how all problems were resolved;
- a listing of quantities and types of materials removed;
- a discussion of removal and disposal options considered for those materials;
- a listing of the ultimate destination of those materials; and
- a presentation of the analytical results of all sampling and analyses performed and accompanying appendices containing all relevant paperwork accrued during the action (e.g., manifests, invoices, bills, contracts).

The Final Report will be submitted within 30 calendar days of completion of the work.

6.1 CERTIFICATION

The Final Report will include an affidavit from a person who directed the preparation of the report. The affidavit will certify under penalty of law that, based on personal knowledge and appropriate inquiries of all other persons involved in the preparation of the report, that the information submitted is true, accurate and complete to the best of the affiant's knowledge and belief.

APPENDIX F

COMMERCIAL OIL SERVICES
DE MINIMIS QUALIFIED TRUST AGREEMENT

THIS TRUST AGREEMENT is made this, _____ day of _____, 19____, by and between the Executive Committee established by and under the Commercial Oil Services Site Participation Agreement whose authorized representatives have executed this Agreement (hereinafter "Executive Committee"), as settlor, and the Trustees who have executed this Agreement.

WHEREAS the Capped De Minimis Respondents, the De Minimis Respondents, and the Federal Agency Respondents have entered into an Administrative Order by Consent with the U.S. EPA with respect to Phase II activities at the Commercial Oil Services Site, and the Capped De Minimis Respondents and De Minimis Respondents have entered into a separate Agreement known as the Commercial Oil Services Site Participation Agreement (the "Participation Agreement") (a current copy of which will be provided to the Trustees); and

WHEREAS this Agreement is established pursuant to the requirements of and to satisfy the obligations of the Administrative Order by Consent; and

WHEREAS the Capped De Minimis Respondents, the De Minimis Respondents, and the Federal Agency Respondents have contributed monies to this Trust upon approval of the Administrative Order by Consent by the U.S. EPA and pursuant to the Administrative Order by Consent, or the Participation Agreement, or both.

NOW THEREFORE, the Trustees hereby agree they will hold, manage, invest and reinvest the monies contributed to the Trust, as required by the Administrative Order by Consent and the Participation Agreement, together with any other property hereafter conveyed, assigned, transferred or paid to them, as Trustees, in Trust, subject to the terms, provisions and conditions hereinafter set forth:

1. DEFINITIONS.

As used in this Trust Agreement:

1.1 The term Administrative Order by Consent ("AOC") shall mean the AOC (a copy of which will be provided to the Trustees) entered into by the U.S. EPA and the Capped De Minimis Respondents, the De Minimis Respondents, and the Federal Agency Respondents with respect to the Commercial Oil Services Site located in Oregon, Ohio.

1.2 The term "Capped De Minimis Respondents" and the "De Minimis Respondents" shall have the same meaning as in the Participation Agreement.

1.3 The term "Federal Agency Respondent" shall have the same meaning as in the Administrative Order by Consent.

1.4 The term "Commercial Oil Services Site" shall have the meaning assigned to the term "Site" in the AOC.

1.5 The term "Trustees" shall mean the individuals who have executed this Agreement as Trustees and any successor or successors to such individuals who are acting as Trustees hereunder.

1.6 The term "EPA" shall mean the United States Environmental Protection Agency.

2. NAME AND PURPOSE OF TRUST.

This Trust shall be known as the Commercial Oil Services De Minimis Qualified Trust Fund (the "Qualified Fund"). The purpose of the Qualified Fund is to obtain, hold, invest, and disburse funds necessary to satisfy the obligations of the Capped De Minimis Respondents, De Minimis Respondents, and Federal Agency Respondents pursuant to the AOC to pay for Past Response Costs and Oversight Costs, as those terms are defined in the AOC and to implement the Work Plan, as that term is defined in the AOC, and to enter into contracts and agreements as directed by the Executive Committee to achieve those purposes. To fulfill this purpose, the Trustees shall thoroughly familiarize themselves with the terms of the Participation Agreement.

3. CONTRIBUTIONS TO THE FUND.

3.1 **Payments into the Fund.** Pursuant to the Participation Agreement, the Capped De Minimis Respondents and De Minimis Respondents have agreed to and the Executive Committee has the Power to instruct the Capped De Minimis Respondents and De Minimis Respondents to make contributions to the Qualified Fund to fund the Past Response Costs, and Oversight Response Costs and to implement the Work Plan pursuant to the AOC in such amounts as are required pursuant to the Participation Agreement. Payments into the Qualified Trust Fund by the Federal Agency Respondents shall be governed by Paragraph 20 of the AOC.

3.2 **Nature of Contributions.** All contributions to the Trustees for the Qualified Fund shall be made in immediately available funds. All such contributions, together with the earnings thereon, shall be held as a trust fund for the payment of the costs and expenses to be incurred by the Trustees as herein provided. Contributions made by the Capped De Minimis Respondents and De Minimis Respondents shall not be construed as fines, penalties, or monetary sanctions.

4. DISPOSITIVE PROVISIONS.

4.1 Payment of Income and Principal. During the term of this Trust, the Trustees shall pay or apply such part (or all) of the income and principal of the Qualified Fund as they deem advisable in order to pay the approved costs at the direction of the Executive Committee, or its designees, in satisfying the Members' obligations under the AOC, including without limitation, to pay for Past Response Costs and Oversight Response Costs, and to pay for the implementation of the Work Plan. In this regard, the Trustees shall pay all bills and invoices approved for payment in writing by the Executive Committee or its designees.

4.2 No Authority to Conduct Business. The purpose of the Qualified Fund is limited to the matters set forth in Sections 2 and 3 hereof, and this Agreement shall not be construed to confer upon the Trustees any authority to carry on any business or activity for profit or to divide the gains therefrom among the Executive Committee.

4.3 Time of Termination of Trust. This Trust shall terminate upon the latter of termination of the AOC and Participation Agreement, or distribution of the Qualified Fund pursuant to Section 4.4 hereof and upon approval of the EPA. In no event, however, shall this Trust continue for a period in excess of twenty-one (21) years from the date of death of the last to die of the persons named in Appendices A and B hereto or their descendants who are living as of the date hereof.

4.4 Distribution of Fund Upon Termination. Upon termination of the AOC and the Participation Agreement, the Trustees shall liquidate the assets of the Qualified Fund and thereupon distribute the remaining trust property, including all accrued accumulated and undistributed net income, to fund the Past Response Costs or Oversight Response Costs, or to fund the implementation of the Work Plan pursuant to the AOC as designated by the Executive Committee pursuant to the Participation Agreement. In no event shall any distribution of the Qualified Fund, including any accrued, accumulated and undistributed net income be made to the Capped De Minimis Respondents or the De Minimis Respondents.

4.5 Alterations, Amendments and Revocation. This Trust Agreement may be altered, amended, or revoked from time to time by an instrument in writing executed by the Trustees and by the Executive Committee as provided in the Participation Agreement; provided, however, that no such alteration, amendment, or revocation may conflict with or modify in any respect the obligations of the Respondents, Capped De Minimis Respondents, De Minimis Respondents, and Federal Agency Respondents under the AOC, and provided further that Section 11 hereof shall not be revoked and shall not be altered or amended to limit the effect thereof

with respect to acts or omissions taken or made up to thirty (30) days after such alteration or amendment.

5. TRUSTEES MANAGEMENT:

The Trustees shall invest and reinvest the principal and income of the Qualified Fund and keep the Qualified Fund invested in one or more accounts which shall be treated as a single fund without distinction between principal and income. All investments shall be made so as to at all times provide sufficient liquidity to meet the anticipated cash needs of the Qualified Fund. In investing, reinvesting, exchanging, selling and managing the Qualified Fund, the Trustees shall discharge their duties with respect to the Qualified Fund solely in the interest of the accomplishment of the purposes and objectives of this Trust Agreement. The Trustees may engage the services of an investment advisor or manager, may rely on the advice of such advisor or manager, and may delegate investment decision-making authority to such advisor or manager with respect to management of the Qualified Fund. The Trustees shall not be personally liable for any action or inaction taken in good faith reliance on the advice of such advisor or manager, nor for delegation in good faith of investment decision-making authority to such advisor or manager. The Trustees shall keep or arrange to be kept an accounting of all contributions to and disbursements from the Qualified Fund.

6. EXPRESS POWERS OF TRUSTEES.

Without in any way limiting the powers and discretion conferred upon the Trustees by the other provisions of this Trust Agreement or by law, the Trustees are expressly authorized and empowered:

6.1 Payment of Expenses of Administration. Upon obtaining approval of or direction from the Executive Committee, to incur and pay any and all charges, taxes, and expenses upon or connected with the Qualified Fund in the discharge of their fiduciary obligation under this Agreement. All such payments shall be made using the assets of the Qualified Fund.

6.2 Retention of Property. To hold and retain all or any part of the Qualified Fund in the form in which the same may be at the time of the receipt by the Trustees, as long as they shall deem advisable, notwithstanding that the same may not be authorized by the laws of any state or rules of any court for the investment of trust funds, and without any liability for any loss of principal or income by reason of such retention.

6.3 Preservation of Principal. Notwithstanding any other provisions in this Agreement, to at all times hold, manage, invest,

and reinvest the assets of the Qualified Fund in a manner designed to preserve the accrued income and principal of the Qualified Fund for the purposes of the Qualified Fund.

6.4 Retention of Investment Advisor and Other Consultants. Upon obtaining approval of or direction from the Executive Committee, to engage the services of (and pay compensation to) an investment advisor, accountants, agents, managers, or other consultants with respect to the management of investments of the Qualified Fund, the management of the Qualified Fund, or any other matters.

6.5 Execution of Documents of Transfer. Upon obtaining approval of or direction from the Executive Committee, to make, execute, acknowledge and deliver any and all documents of transfer and conveyance and any and all other instruments that may be necessary or appropriate to carry out the powers herein granted.

6.6 Extension of Obligations and Negotiations of Claims. Upon obtaining approval of or direction from the Executive Committee, to renew or extend the time of payments of any obligation payable to or by the Qualified Fund for such periods of time and on such terms as the Trustees shall determine; and upon obtaining approval of or direction from the Executive Committee, to compromise or otherwise adjust all claims in favor of or against the Qualified Fund.

6.7 Execution of Contracts and Agreements. Upon obtaining approval of or direction from the Executive Committee, to make, execute, acknowledge, and deliver any and all contracts or agreements.

6.8 Qualified Settlement Fund Regulations. To do any and all other acts which they shall deem reasonable and appropriate to satisfy the requirements of and to otherwise comply with the Internal Revenue Service regulations relating to Qualified Settlement Funds.

6.9 Discretion in Exercise of Powers. To do any and all other acts which they shall deem proper to effectuate the purpose hereof and to exercise the powers specifically conferred upon them by this Trust Agreement.

7. GOVERNANCE OF THE TRUSTEES.

7.1 Majority. Action may be taken, except as otherwise provided herein, by a majority of the Trustees then in office at any meeting of the Trustees, at which a quorum is present. At any meeting of the Trustees, a majority of the Trustees then in office shall constitute a quorum for the transaction of business. Less

than a quorum may adjourn any meeting from time to time, and the meeting may be held as adjourned without further notice.

7.2 Meetings. Any action may be taken by the Trustees without a meeting if all the Trustees then in office consent to the action in writing and such written consents are filed with the records of the Trustees.

7.3 Expenditures. Any expenditure from the Fund of an amount greater than Ten Thousand Dollars (\$10,000.00) for any single transaction shall require the signature of two (2) Trustees, in addition to the required direction and approval of the Executive Committee.

8. TRUSTEE COMPENSATION.

No Trustee shall receive any compensation for his services as a Trustee under this Trust Agreement; provided, however, that any Trustee may be reimbursed for out-of-pocket expenses, relating to the performance of his duties as Trustees, including but not limited to, expenses for travel, mail, telephone, facsimile, and meeting rooms.

9. SUCCESSOR TRUSTEES.

9.1 Vacancy caused by Resignation or Removal. Any Trustee may resign at any time by delivering his resignation in writing to the Executive Committee; or the Executive Committee may remove any Trustee, by delivering notice of such removal in writing to such Trustee; such resignation or removal to take effect within thirty (30) days of delivery of the notice of resignation or removal, or upon the acceptance of appointment in writing by a successor Trustee, whichever is earlier.

9.2 Appointment of Successor Trustees. Any vacancy in the office of Trustee created by death, resignation or removal by the Executive Committee of a Trustee shall be filled by the Executive Committee by an appointment in writing of a successor Trustee.

9.3 Acceptance of Appointment by Successor Trustees. Acceptance of appointment as a successor Trustee shall be in writing and shall become effective upon receipt by the Executive Committee of notice of such acceptance. Upon the acceptance of appointment of any successor Trustee, title to the Qualified Fund shall thereupon be vested in said successor Trustee, jointly with the remaining Trustees, if any, without the necessity of any conveyance or instrument. Each successor Trustee shall have all of the rights, powers, duties, authority, and privileges as if initially named as a Trustee hereunder.

9.4 **Preservation of Record of Changes in Trustees.** A copy of each instrument of resignation, removal, appointment and acceptance of appointment shall be attached to an executed counterpart of this Trust Agreement in the custody of the Executive Committee.

9.5 **Notice to EPA.** Any vacancy caused by resignation or removal of a Trustee and subsequent appointment of Successor Trustees shall be reported to the EPA by the remaining Trustees.

10. INSTRUCTIONS TO THE TRUSTEES.

Notwithstanding anything herein to the contrary, the Trustees are hereby directed to do the following in addition to other duties set forth in other provisions of this Trust Agreement:

10.1 **Quarterly Reports.** Have prepared quarterly financial reports describing the manner in which all of the assets of the Qualified Fund are then invested and the current market value of such assets, as well as the obligations, income, and expenses of the Qualified Fund [Trust]. Copies of such reports shall be transmitted in writing to the Executive Committee.

10.2 **Annual Statements.** Have prepared annual financial statements describing the manner in which all of the assets of the Qualified Fund are then invested and the current market value of such assets, as well as the obligations, income and expenses of the Qualified Fund. All financial statements shall be prepared on an accrual basis, and shall be in accordance with Generally Accepted Accounting Principles, applied on a consistent basis. Copies of such statements shall be transmitted in writing to the Executive Committee and to the EPA.

10.3 **Counsel.** Advise, consult and confer with and otherwise inform the Executive Committee upon any request by the Executive Committee or with respect to matters arising out of this Trust Agreement, administration of the Qualified Fund, of any other matter which the Trustees, in their discretion, deem appropriate to bring to the attention of the Executive Committee.

10.4 **Records.** Maintain records of all actions taken by the Trustees with respect to matters arising out of this Trust Agreement or administration of the Qualified Fund. Copies of said records shall be provided to the Executive Committee upon request, and upon termination of this Trust said records shall be transmitted, together with all other records of the Trustees, to the Executive Committee. In due course after the execution of this Agreement the Executive Committee will notify the Trustees in writing of the means and procedures by which the Executive Committee will direct, advise and otherwise communicate with the Trustees. Thereafter, the Trustees shall be entitled to assume that all directions, advice and other communications which are

transmitted to the Trustees by such means and procedures are authorized by the Executive Committee and accurately express its position on the item in question.

The Trustees shall have the right to assume, in the absence of written notice to the contrary, that no event constituting a change or a termination of the authority of any member of the Executive Committee has occurred.

11. IMMUNITY AND INDEMNIFICATION.

11.1 Indemnity. Each Trustee, whether initially named or appointed as a successor Trustee, acts as a Trustee only and not personally; and in respect of any contract, obligation of liability made or incurred by the Trustees or any of them hereunder in good faith, all persons shall look solely to the Qualified Fund and not the Trustees personally. No Trustee shall incur any liability, personal or corporate, of any nature in connection with any act or omission, made in good faith, of the Trustees in the administration of the Qualified Fund or otherwise pursuant to this Trust Agreement. The Trustees initially named, or appointed as successor Trustees by the Executive Committee, shall be indemnified and held harmless by the Qualified Fund and by the Members of the Participation Agreement. This indemnification and hold harmless provision shall cover all expenses reasonably incurred by such Trustee in defense of the aforementioned acts or omissions of the Trustees. This indemnification shall not apply to any liability arising from a criminal proceeding where the Trustees(s) had reasonable cause to believe that conduct in question was unlawful.

11.2 Survival. This section shall survive the termination of the Trust Agreement.

12. CHOICE OF LAW.

This Trust Agreement shall be administered, construed, and enforced according to the laws of the State of Ohio, except to the extent that federal law shall apply to questions arising under the Comprehensive Environmental Response, Compensation and Liability Act, or the National Contingency Plan.

13. INTERPRETATION.

As used in this Trust Agreement, words in the singular include the plural and words in the plural include the singular; and the masculine and neuter genders shall be deemed to include the masculine, feminine and neuter. The descriptive heading for each Section and Subsection of the Trust Agreement shall not affect the interpretation or the legal efficacy of this Trust Agreement nor

any contribution to the Qualified Fund nor shall any action taken under this Trust Agreement be deemed to constitute an admission of any liability of fault on the part of the Trustees or the Executive Committee or the Capped De Minimis Respondents or the De Minimis Respondents, or any of them, with respect to the Commercial Oil Services Site or otherwise, nor does it constitute a commitment or agreement, either expressed or implied, by any or all of them to undertake any further activities outside the scope of the AOC and the Participation Agreement.

14. SEPARATE DOCUMENTS.

This Agreement may be executed in two or more counterparts, each of which shall be deemed an original, but all of which together shall constitute the same instrument.

IN WITNESS WHEREOF, this Agreement has been duly executed and delivered for and in the name and on behalf of the Executive Committee, Settlers and of the Trustees, effective as of the date first above written.

Attest:

TRUSTEES:

_____, Trustee

_____, Trustee

_____, Trustee

COMMERCIAL OIL SERVICES

DE MINIMIS QUALIFIED TRUST
AGREEMENT SIGNATORY PAGE

_____, in capacity
of a Member of the Executive Committee pursuant to the Commercial
Oil Services Site Participation Agreement, hereby enters into and
agrees to be bound by the Commercial Oil Services De Minimis
Qualified Trust Agreement ("Trust Agreement"), effective
_____. The undersigned is duly authorized to enter into
this Trust Agreement on behalf of the Members of the Commercial Oil
Services Site Participation Agreement.

By: _____

Dated: _____

RANK	RESPONSIBLE PARTY	VOLUME (Gallons)	PERCENT	PROJECTED TOTAL SHARE	PREVIOUS PAYMENTS	PHASE I TIME VALUE ASSESSMENT	PROJECTED SHARE NET PREVIOUS PAYMENTS	CAPPED DE MINIMIS	DE MINIMIS
1	GENERAL MOTORS CORPORATION	13,355,351.58	29.8475%	\$11,340,297.42	\$2,191,490.49		\$9,148,806.93		
2	INTERLAKE STEEL	2,947,209.00	6.5866%	\$2,502,534.39	\$331,249.59		\$2,171,284.80		
3	DANA CORP. DIV: SPICER TRANSMISSION	2,822,511.00	6.3079%	\$2,396,650.81	\$829,695.68		\$1,566,955.13		
4	SHARON MANUFACTURING/CHAMPION	2,385,057.61	5.3303%	\$2,025,200.35	\$303,606.61		\$1,721,593.74		
5	CHRYSLER MOTORS CORPORATION	1,797,090.00	4.0163%	\$1,525,945.23	\$284,335.83		\$1,241,609.41		
6	GULF OIL CO.	1,608,157.00	3.5940%	\$1,365,518.43	\$230,941.08		\$1,134,577.34		
7	LIBBEY-OWENS-FORD CO.	1,602,310.00	3.5810%	\$1,360,553.62	\$230,891.83		\$1,129,661.79		
8	STANDARD OIL CO.	1,288,619.00	2.8754%	\$1,092,494.05	\$112,810.18		\$979,683.87		
9	TOLEDO EDISON	1,080,794.00	2.4154%	\$917,723.91	\$73,757.57		\$843,966.33		
10	TOTAL PETROLEUM, INC.	1,039,514.50	2.3232%	\$882,672.65	\$133,623.81		\$749,048.84		
11	TELEDYNE C.A.E.	887,197.00	1.9828%	\$753,338.80	\$119,101.89		\$634,236.91		
12	INLAND CHEMICAL CORPORATION	797,633.00	1.7826%	\$677,286.21	\$183,591.98		\$493,694.23		
13	LUBRIZOL CORPORATION, THE	666,681.12	1.4899%	\$566,092.34	\$99,292.79		\$466,799.55		
14	TRUCKSTOPS OF AMERICA	497,145.00	1.1111%	\$422,135.81	\$55,472.20		\$366,663.61		
15	KOPPERS COMPANY, INC.	473,462.00	1.0581%	\$402,026.10		\$25,476.85	\$402,026.10		
16	KONCOR INDUSTRIES	455,000.00	1.0169%	\$386,349.64	\$55,780.48		\$330,569.16		
17	MATLACK, INC.	440,226.00	0.9838%	\$373,804.74	\$44,982.00		\$328,822.74	\$476,244.39	\$623,668.04
18	FORD MOTOR CO.	429,775.00	0.9605%	\$364,930.59	\$54,291.28		\$310,639.31	\$454,561.18	\$598,483.00
19	BRUSH WELLMAN INC.	341,537.00	0.7633%	\$290,005.93	\$48,686.98		\$241,318.95	\$355,691.90	\$470,064.65
20	SUPERIOR OVERALL LAUNDRY CO.	329,071.00	0.7354%	\$279,420.80		\$17,707.22	\$279,420.80	\$407,326.39	\$517,524.78
21	OWENS-ILLINOIS	328,253.80	0.7336%	\$278,726.90	\$22,000.57		\$256,726.33	\$366,651.04	\$478,575.75
22	PETERS STAMPING CO.	321,800.00	0.7192%	\$273,246.85		\$17,315.97	\$273,246.85	\$398,326.29	\$506,089.77
23	LIBRA INDUSTRIES, INC. OF MICHIGAN	317,938.00	0.7105%	\$269,967.55		\$17,108.15	\$269,967.55	\$393,545.88	\$500,018.07
24	REFINERS TRANSPORT & TERMINAL CORP.	285,446.00	0.6379%	\$242,377.94	\$32,272.41		\$210,105.53	\$305,694.88	\$401,284.24
25	DONOVAN STEEL, INC.	272,239.00	0.6084%	\$231,163.61		\$14,649.10	\$231,163.61	\$336,979.34	\$428,145.97
26	GULF WESTERN METALS FORMING CO.	266,465.00	0.5955%	\$226,260.79	\$3,815.82		\$222,444.98	\$311,878.01	\$401,111.07
27	BENDIX AUTOLITE CORPORATION	261,100.00	0.5835%	\$221,705.26		\$14,049.72	\$221,705.26	\$323,181.41	\$410,627.84
28	FISKE BROTHERS REFINING CO.	253,783.00	0.5672%	\$215,492.25		\$13,655.99	\$215,492.25	\$314,134.37	\$399,120.51
29	ROADWAY SERVICES, INC.	222,398.00	0.4970%	\$188,842.61	\$25,568.40		\$163,274.21	\$237,750.23	\$312,226.24
30	UNION CARBIDE CORPORATION	216,603.00	0.4841%	\$183,921.98	\$26,382.28		\$157,539.68	\$230,075.08	\$302,610.49
31	AMERICAN SHIP BUILDING	195,330.00	0.4365%	\$165,858.63	\$2,066.18		\$163,792.44	\$229,204.01	\$294,615.57
32	MANVILLE SALES CORPORATION	187,548.00	0.4191%	\$159,250.78	\$16,870.19		\$142,380.59	\$206,186.13	\$267,991.68
33	CROWN CORK & SEAL CO., INC.	183,275.00	0.4096%	\$155,622.49		\$9,861.98	\$155,622.49	\$226,859.08	\$288,233.70
34	SHIFFERLY OVERSEAS LAKE SHIPPING	173,300.00	0.3873%	\$147,152.51		\$9,325.22	\$147,152.51	\$214,511.95	\$272,546.17
35	TECUMSEH PRODUCTS	169,286.79	0.3783%	\$143,744.82	\$25,218.18		\$118,526.65	\$175,216.94	\$231,907.22
36	METAL FORGE COMPANY	163,985.00	0.3665%	\$139,242.96	\$21,650.72		\$117,592.24	\$172,507.08	\$227,421.91
37	DOEHLER JARVIS CASTINGS	163,896.00	0.3663%	\$139,167.39	\$19,860.48		\$119,306.92	\$174,191.98	\$229,076.99
38	SUN OIL COMPANY	158,210.00	0.3536%	\$134,339.29	\$17,477.18		\$116,862.13	\$169,843.05	\$222,823.97
39	TOLEDO STEEL TUBE CO.	156,791.00	0.3504%	\$133,134.39		\$8,436.88	\$133,134.39	\$194,077.00	\$246,582.73
40	AMERICAN CHAIN & CABLE CO., INC.	156,300.00	0.3493%	\$132,717.47		\$8,410.48	\$132,717.47	\$193,469.23	\$245,810.54
41	COASTAL TANK LINES, INC.	141,780.00	0.3169%	\$120,388.25		\$7,629.14	\$120,388.25	\$175,496.28	\$222,975.17
42	DURA CORPORATION	138,247.00	0.3090%	\$117,388.31		\$7,439.03	\$117,388.31	\$171,123.10	\$217,418.87
43	HUNT-WESSON, INC.	121,918.00	0.2725%	\$103,523.02	\$14,494.68		\$89,028.35	\$129,855.91	\$170,683.46
44	UNION OIL	118,810.00	0.2655%	\$100,883.96		\$8,393.13	\$100,883.96	\$147,063.85	\$186,850.61

RANK	RESPONSIBLE PARTY	VOLUME (Gallons)	PERCENT	PROJECTED TOTAL SHARE	PREVIOUS PAYMENTS	PHASE I TIME VALUE ASSESSMENT	PROJECTED SHARE NET PREVIOUS PAYMENTS	CAPPED DE MINIMIS	DE MINIMIS
45	COUSINS CO.	118,340.00	0.2645%	\$100,484.87		\$6,367.84	\$100,484.87	\$146,482.08	\$186,111.45
46	CSXT (CHESSIE SYSTEMS/B&O RAILROAD)	115,255.78	0.2576%	\$97,866.00	\$18,218.73		\$81,647.27	\$120,243.80	\$158,840.33
47	USHER OIL SERVICE	114,600.00	0.2561%	\$97,309.16		\$6,166.59	\$97,309.16	\$141,852.68	\$180,229.81
48	HARVEY ALUMINUM CO.	111,850.00	0.2500%	\$94,974.08		\$6,018.62	\$94,974.08	\$136,448.71	\$175,904.73
49	GLADIEUX CORP.	111,420.00	0.2490%	\$94,608.96		\$5,995.48	\$94,608.96	\$137,916.46	\$175,228.47
50	CHEMCENTRAL	109,725.00	0.2452%	\$93,169.70	\$12,819.18		\$80,550.54	\$117,294.94	\$154,039.34
51	SUNDSTRAND CORPORATION	96,322.00	0.2153%	\$81,788.95		\$5,183.08	\$81,788.95	\$119,228.05	\$151,484.09
52	AVERY INTERNATIONAL	93,101.00	0.2081%	\$79,053.93		\$5,009.74	\$79,053.93	\$115,241.07	\$148,418.47
53	OHIO EDISON CO.	91,873.00	0.2053%	\$78,011.21		\$4,943.68	\$78,011.21	\$113,721.04	\$144,407.22
54	UNION 76	81,768.00	0.1827%	\$69,430.85		\$4,399.91	\$69,430.85	\$101,213.00	\$128,595.24
55	MERCE INDUSTRIES, INC.	81,350.00	0.1818%	\$69,075.92		\$4,377.42	\$69,075.92	\$100,695.60	\$127,937.80
56	HAVILAND PRODUCTS COMPANY	70,909.50	0.1585%	\$60,210.68		\$3,815.62	\$60,210.68	\$87,772.28	\$111,518.25
57	PENN CENTRAL COMPANY	67,408.00	0.1506%	\$57,237.49		\$3,627.21	\$57,237.49	\$83,438.09	\$106,011.50
58	SCHINDLER ELEVATOR CORPORATION	67,282.00	0.1504%	\$57,130.50	\$8,747.50		\$48,383.00	\$70,914.20	\$93,445.41
59	COLUMBIA TRANSPORTATION DIV.	67,150.00	0.1501%	\$57,018.41		\$3,613.32	\$57,018.41	\$83,118.74	\$105,605.74
60	TARTA	63,810.00	0.1426%	\$54,182.35		\$3,433.60	\$54,182.35	\$78,984.46	\$100,352.98
61	KELSEY - HAYES AUTO - TRUCK GROUP	59,272.00	0.1325%	\$50,329.05		\$3,189.41	\$50,329.05	\$73,367.30	\$93,218.14
62	CITIES SERVICE CO.	59,121.00	0.1321%	\$50,200.83	\$8,554.48		\$43,646.34	\$63,444.62	\$83,242.89
63	LIQUID CARBONIC (CO2 CORPORATION)	57,382.00	0.1282%	\$48,724.21		\$3,087.71	\$48,724.21	\$71,027.84	\$90,243.70
64	PETTY, M. & SONS ENTERPRISES, INC.	50,245.00	0.1123%	\$42,664.04		\$2,703.67	\$42,664.04	\$62,193.81	\$79,019.52
65	N & W RAILROAD	48,439.00	0.1083%	\$41,130.53		\$2,608.49	\$41,130.53	\$59,958.13	\$78,179.25
66	MICHIGAN - OHIO PIPELINE CO.	46,983.00	0.1050%	\$39,894.21	\$2,592.15		\$37,302.08	\$53,035.59	\$68,769.13
67	HEIST, C. H. CORPORATION	46,022.00	0.1029%	\$39,078.21		\$2,476.43	\$39,078.21	\$58,968.35	\$72,378.07
68	CERTAINTED CORPORATION	42,300.00	0.0945%	\$35,917.78	\$8,783.88		\$27,153.90	\$41,319.21	\$55,464.51
69	LAY'S ALLISON TRANSMISSIONS	41,925.00	0.0937%	\$35,599.38		\$2,255.97	\$35,599.38	\$51,895.06	\$65,934.78
70	HOECHST - CELANESE	41,085.00	0.0918%	\$34,886.10		\$2,210.77	\$34,886.10	\$50,855.30	\$64,813.73
71	RANSOM & RANDOLPH DIVISION	40,855.00	0.0913%	\$34,690.80		\$2,198.40	\$34,690.80	\$50,570.81	\$64,252.01
72	EPIC METALS CORPORATION	40,564.00	0.0907%	\$34,443.71		\$2,182.74	\$34,443.71	\$50,210.40	\$63,794.36
73	KAISER ALUMINUM & CHEMICAL CORP.	40,325.00	0.0901%	\$34,240.77	\$5,753.80		\$28,486.97	\$41,990.89	\$55,494.82
74	INTERSTATE SYSTEMS	38,490.00	0.0860%	\$32,682.63		\$2,071.14	\$32,682.63	\$47,643.19	\$60,532.61
75	MARTIN MARIETTA CORPORATION	38,225.00	0.0854%	\$32,457.62		\$2,058.88	\$32,457.62	\$47,315.17	\$60,115.85
76	BROWN MOTORS	38,038.00	0.0850%	\$32,297.13	\$5,779.94		\$26,517.19	\$39,254.58	\$51,991.97
77	KLORER - WILLHARDT, INC.	38,000.00	0.0849%	\$32,266.58		\$2,044.77	\$32,266.58	\$47,036.67	\$59,762.00
78	TANK SERVICE, INC.	34,909.00	0.0780%	\$29,641.93		\$1,878.44	\$29,641.93	\$43,210.60	\$54,900.83
79	ROTH OIL COMPANY	32,000.00	0.0715%	\$27,171.84		\$1,721.91	\$27,171.84	\$39,609.82	\$50,325.69
80	MARVEL/SCHIBLER/TILLOTSON	31,640.00	0.0707%	\$26,866.16	\$2,066.18		\$24,799.98	\$35,395.49	\$45,991.00
81	WESTWAY TRADING CORP.	31,400.00	0.0702%	\$26,662.37		\$1,689.62	\$26,662.37	\$38,887.14	\$49,382.28
82	MANUFACTURERS ENAMELING CORPORATION	31,340.00	0.0700%	\$26,611.42	\$2,066.18		\$24,545.24	\$35,040.29	\$45,535.34
83	SHELL OIL COMPANY	30,928.00	0.0691%	\$26,281.59		\$1,664.23	\$26,281.59	\$38,282.89	\$48,639.96
84	CAMPBELL SOUP COMPANY	30,330.00	0.0678%	\$25,753.81	\$2,066.18		\$23,687.63	\$33,844.45	\$44,001.28
85	ASHLAND OIL	29,290.00	0.0655%	\$24,870.73		\$1,578.09	\$24,870.73	\$38,255.37	\$48,063.92
86	MIDLAND - ROSS CORPORATION	28,408.00	0.0635%	\$24,121.80		\$1,528.63	\$24,121.80	\$35,183.62	\$44,678.61
87	ALLIED SIGNAL	27,990.00	0.0626%	\$23,768.87		\$1,506.13	\$23,768.87	\$34,648.22	\$44,019.43
88	EDDY, BOB BUICK	27,724.00	0.0620%	\$23,541.01		\$1,491.82	\$23,541.01	\$34,318.96	\$43,801.10

RANK	RESPONSIBLE PARTY	VOLUME (Gallons)	PERCENT	PROJECTED TOTAL SHARE	PREVIOUS PAYMENTS	PHASE I TIME VALUE ASSESSMENT	PROJECTED SHARE NET PREVIOUS PAYMENTS	CAPPED DE MINIMIS	DE MINIMIS
89	MAJOR LAUNDRY	27,100.00	0.0606%	\$23,011.15		\$1,458.24	\$23,011.15	\$33,544.57	\$42,619.74
90	TUFF-KOTE DINOL, INC.	26,895.00	0.0601%	\$22,837.08		\$1,447.21	\$22,837.08	\$33,290.82	\$42,297.34
91	POLAR, INC. (Indust. Petrol. & Amer. Tank)	26,013.00	0.0581%	\$22,088.18		\$1,399.75	\$22,088.18	\$32,199.07	\$40,910.23
92	NATIONAL BISCUIT CO.	25,093.00	0.0561%	\$21,306.97	\$2,068.18		\$19,240.79	\$27,843.88	\$36,046.93
93	MOLDER, RAY CARRIER CORP.	24,975.00	0.0558%	\$21,208.77	\$2,068.18		\$19,140.59	\$27,504.15	\$35,867.71
94	COOPER TIRE & RUBBER COMPANY	23,100.00	0.0516%	\$19,614.67		\$1,243.00	\$19,614.67	\$28,593.34	\$36,329.00
95	MAUMEE METAL TREATING COMPANY	23,000.00	0.0514%	\$19,529.76		\$1,237.62	\$19,529.76	\$28,469.58	\$36,171.74
96	MORGAN LINEN & IND. SERVICES	23,000.00	0.0514%	\$19,529.76		\$1,237.62	\$19,529.76	\$28,469.58	\$36,171.74
97	BALLAS, GEORGE BUICK-GMC TRUCK	21,690.00	0.0485%	\$18,417.41		\$1,167.13	\$18,417.41	\$26,648.03	\$34,111.52
98	DAVIS, HARRY & SONS	21,550.00	0.0482%	\$18,298.54		\$1,159.60	\$18,298.54	\$26,874.74	\$33,891.34
99	CAREY PLASTICS	20,895.00	0.0467%	\$17,742.36		\$1,124.35	\$17,742.36	\$25,863.98	\$32,861.24
100	PEMBERTON CADILLAC CO.	20,652.00	0.0462%	\$17,536.03		\$1,111.28	\$17,536.03	\$25,563.19	\$32,479.07
101	COULTON CHEMICAL CORPORATION	20,100.00	0.0449%	\$17,067.31		\$1,081.58	\$17,067.31	\$24,879.82	\$31,610.95
102	MIDWEST MICA & INSULATION COMPANY	19,430.00	0.0434%	\$16,498.40		\$1,045.52	\$16,498.40	\$24,050.59	\$30,557.25
103	PETERSON AMERICAN CORP.	19,220.00	0.0430%	\$16,320.09	\$2,068.18		\$14,253.90	\$20,690.24	\$27,126.58
104	ARCO PIPE LINE CO.	18,286.00	0.0409%	\$15,527.01		\$983.96	\$15,527.01	\$22,634.54	\$28,758.10
105	LOWNSBURY CHEVROLET	17,885.00	0.0400%	\$15,186.51		\$962.39	\$15,186.51	\$22,138.18	\$28,127.48
106	SCHMIDT, ED PONTIAC	17,833.00	0.0399%	\$15,142.36		\$959.59	\$15,142.36	\$22,073.81	\$28,045.68
107	CENTREX CORP.	17,708.00	0.0396%	\$15,036.22		\$952.86	\$15,036.22	\$21,919.09	\$27,849.09
108	INMONT	17,705.00	0.0396%	\$15,033.67		\$952.70	\$15,033.67	\$21,915.37	\$27,844.37
109	NATIONAL CEMENT PRODUCTS COMPANY	17,520.00	0.0392%	\$14,876.58		\$942.75	\$14,876.58	\$21,888.38	\$27,553.43
110	INTERNATIONAL DEMOLITION	17,360.00	0.0388%	\$14,740.72		\$934.14	\$14,740.72	\$21,488.33	\$27,301.80
111	TOLEDO AUTO DEALERS ASSOCIATION (TADA)	16,072.00	0.0359%	\$13,647.08		\$864.83	\$13,647.08	\$19,894.03	\$25,278.18
112	GOULD, INC., OCEAN SYSTEMS DIVISION	15,725.25	0.0351%	\$13,352.63		\$846.17	\$13,352.63	\$19,464.82	\$24,730.85
113	EMPIRE PETROLEUM, INC.	15,696.00	0.0351%	\$13,327.79		\$844.60	\$13,327.79	\$19,428.62	\$24,684.85
114	BRONDES MOTOR SALES, INC.	15,350.00	0.0343%	\$13,033.99		\$825.98	\$13,033.99	\$19,000.34	\$24,140.70
115	TRUCKWORLD OF TOLEDO	15,082.00	0.0337%	\$12,806.43		\$811.58	\$12,806.43	\$18,868.81	\$23,719.22
116	VULCAN MATERIALS COMPANY (METALS DIV.)	15,000.00	0.0335%	\$12,736.80		\$807.15	\$12,736.80	\$18,567.11	\$23,590.28
117	BURGE, C. S., INC.	14,926.00	0.0334%	\$12,673.97		\$803.18	\$12,673.97	\$18,475.51	\$23,473.88
118	MCKITRICK, W. D. CO., INC.	14,250.00	0.0318%	\$12,099.96		\$768.79	\$12,099.96	\$17,838.75	\$22,410.75
119	MILFORD RIVET & MACHINE CO.	14,225.00	0.0318%	\$12,078.73		\$765.44	\$12,078.73	\$17,607.80	\$22,371.43
120	CHEMTRON CORP.	14,120.00	0.0316%	\$11,989.58		\$759.79	\$11,989.58	\$17,477.83	\$22,200.30
121	CENTRAL TRANSPORT	13,680.00	0.0306%	\$11,815.96		\$738.12	\$11,815.96	\$16,933.20	\$21,514.32
122	BFI/COMMERCIAL TRUCK REPAIR	13,500.00	0.0302%	\$11,463.12		\$726.43	\$11,463.12	\$16,710.39	\$21,231.24
123	BRAUN & WIEDER CONSTRUCTION CO.	13,500.00	0.0302%	\$11,463.12		\$726.43	\$11,463.12	\$16,710.39	\$21,231.24
124	PERRYBURG PUBLIC SCHOOLS	13,460.00	0.0301%	\$11,429.16		\$724.28	\$11,429.16	\$16,660.88	\$21,168.33
125	HATFIELD OLDSMOBILE, INC.	13,416.00	0.0300%	\$11,391.80		\$721.91	\$11,391.80	\$16,608.42	\$21,099.13
126	GRANGER, DON CAR WASH	13,400.00	0.0299%	\$11,378.21		\$721.05	\$11,378.21	\$16,588.81	\$21,073.97
127	DEFIANCE SCREW MACHINE PRODUCTS	13,000.00	0.0291%	\$11,038.56		\$699.53	\$11,038.56	\$16,091.49	\$20,444.89
128	U.S. REDUCTION CO.	12,975.00	0.0290%	\$11,017.33		\$698.18	\$11,017.33	\$16,060.55	\$20,405.58
129	U-HAUL INTERNATIONAL	12,500.00	0.0279%	\$10,814.00		\$672.82	\$10,814.00	\$15,472.59	\$19,658.55
130	GREAT LAKES ENERGY SYSTEMS	12,400.00	0.0277%	\$10,529.09		\$667.24	\$10,529.09	\$15,348.81	\$19,501.28
131	SCHMIDT, BOB CHEVROLET, INC.	12,280.00	0.0274%	\$10,427.19		\$660.78	\$10,427.19	\$15,200.27	\$19,312.58
132	RUSSELL, BURDSALL AND WARD CO.	11,955.00	0.0267%	\$10,151.23		\$643.30	\$10,151.23	\$14,797.98	\$18,801.44

RANK	RESPONSIBLE PARTY	VOLUME (Gallons)	PERCENT	PROJECTED	PREVIOUS PAYMENTS	PHASE I	PROJECTED	CAPPED DE MINIMIS	DE MINIMIS
				TOTAL SHARE		TIME VALUE ASSESSMENT	SHARE NET PREVIOUS PAYMENTS		
133	LEAR SIEGLER, INC.	11,855.00	0.0265%	\$10,066.32	\$2,068.18		\$8,000.13	\$11,970.10	\$15,940.07
134	WEISENBERGER CHEVY	11,850.00	0.0260%	\$9,892.25		\$828.88	\$9,892.25	\$14,420.45	\$18,321.77
135	WHITE, DAVE CHEVROLET	11,394.00	0.0255%	\$9,674.87		\$813.11	\$9,674.87	\$14,103.57	\$17,919.18
138	GUMPP CADILLAC, INC.	11,262.00	0.0252%	\$9,562.79		\$608.00	\$9,562.79	\$13,940.18	\$17,711.57
137	MOORE FORD SALES	10,850.00	0.0242%	\$9,212.95		\$583.84	\$9,212.95	\$13,430.21	\$17,063.62
138	TOLEDO, CITY OF	10,711.00	0.0239%	\$9,094.93	\$4,328.42		\$4,768.51	\$8,353.38	\$11,940.25
139	FRANCE STONE COMPANY	10,600.00	0.0237%	\$9,000.87		\$570.38	\$9,000.87	\$13,120.75	\$16,670.45
140	SENECA WIRE AND MANUFACTURING COMPAN	10,300.00	0.0230%	\$8,745.94		\$554.24	\$8,745.94	\$12,749.41	\$16,198.65
141	SOHIO STATION	10,050.00	0.0225%	\$8,533.66		\$540.79	\$8,533.66	\$12,439.96	\$15,805.48
142	BLACK EQUIPMENT, INC.	9,950.00	0.0222%	\$8,448.74		\$535.41	\$8,448.74	\$12,318.18	\$15,648.21
143	TOLEDO PICKLING & STEEL CO.	9,800.00	0.0219%	\$8,321.38		\$527.34	\$8,321.38	\$12,130.51	\$15,412.31
144	SCOTT, DON CHEVROLET-PONTIAC, INC.	9,650.00	0.0216%	\$8,194.01		\$519.28	\$8,194.01	\$11,944.84	\$15,176.40
145	SAFETY-KLEEN	9,520.00	0.0213%	\$8,083.62		\$512.27	\$8,083.62	\$11,783.92	\$14,971.95
146	SEERY, M. F. & SON	9,500.00	0.0212%	\$8,068.64		\$511.19	\$8,068.64	\$11,759.17	\$14,940.50
147	SENTLE TRUCKING CO.	8,325.00	0.0208%	\$7,918.04		\$501.78	\$7,918.04	\$11,542.55	\$14,665.28
148	SANDUSKY PLASTICS, INC.	9,025.00	0.0202%	\$7,663.31	\$7,791.28		\$1,000.00	\$2,894.31	\$5,918.58
149	INDUSTRIAL HEAT TREATING	9,000.00	0.0201%	\$7,642.08		\$500.00	\$7,642.08	\$11,155.98	\$14,169.87
150	GENERAL ELECTRIC	8,970.00	0.0200%	\$7,618.81		\$500.00	\$7,618.81	\$11,120.48	\$14,124.30
151	BASSMI	8,965.00	0.0200%	\$7,612.36		\$500.00	\$7,612.36	\$11,114.54	\$14,116.71
152	GASTOWN	8,958.00	0.0200%	\$7,604.72		\$500.00	\$7,604.72	\$11,103.88	\$14,103.04
153	WHIRLPOOL	8,925.00	0.0199%	\$7,578.40		\$500.00	\$7,578.40	\$11,067.18	\$14,055.95
154	CONTINENTAL AVIATION AND ENG. CORP.	8,724.00	0.0195%	\$7,407.72		\$500.00	\$7,407.72	\$10,829.19	\$13,750.66
155	COLES OIL SERVICE	8,546.00	0.0191%	\$7,258.58		\$500.00	\$7,258.58	\$10,618.44	\$13,480.30
156	O.H. MATERIALS CORP.	8,500.00	0.0190%	\$7,217.52		\$500.00	\$7,217.52	\$10,563.98	\$13,410.43
157	FONDESSY ENTERPRISES, INC.	8,440.00	0.0189%	\$7,168.57		\$500.00	\$7,168.57	\$10,492.94	\$13,319.30
158	HOOVER BALL & BEARING	8,415.00	0.0188%	\$7,145.35		\$500.00	\$7,145.35	\$10,463.34	\$13,281.33
159	AMERICAN-UNCOLN	8,335.00	0.0186%	\$7,077.42		\$500.00	\$7,077.42	\$10,368.62	\$13,159.82
160	CLEVELAND TWIST DRILL	8,100.00	0.0181%	\$6,877.87		\$500.00	\$6,877.87	\$10,090.38	\$12,802.88
161	STANDARD PRODUCTS CO.	8,100.00	0.0181%	\$6,877.87		\$500.00	\$6,877.87	\$10,090.38	\$12,802.88
162	GOODY'S	8,050.00	0.0180%	\$6,835.42		\$500.00	\$6,835.42	\$10,031.18	\$12,726.94
163	OHIO BELL TELEPHONE	8,050.00	0.0180%	\$6,835.42		\$500.00	\$6,835.42	\$10,031.18	\$12,726.94
164	AU, ROGER J. & SONS, INC.	7,950.00	0.0178%	\$6,750.50		\$500.00	\$6,750.50	\$9,912.78	\$12,575.05
165	GENOA MOTORS, INC.	7,900.00	0.0177%	\$6,708.05		\$500.00	\$6,708.05	\$9,853.58	\$12,499.11
166	BUD INDUSTRIES, INC.	7,865.00	0.0176%	\$6,678.33		\$500.00	\$6,678.33	\$9,812.14	\$12,445.95
167	GENERAL TIRE SERVICE	7,750.00	0.0173%	\$6,580.68		\$500.00	\$6,580.68	\$9,675.98	\$12,271.28
168	EDWARDS FOOD WAREHOUSE	7,727.00	0.0173%	\$6,561.15		\$500.00	\$6,561.15	\$9,648.75	\$12,236.34
169	NASA-LEWIS RESEARCH CENTER	7,500.00	0.0168%	\$6,368.40		\$500.00	\$6,368.40	\$9,379.98	\$11,891.58
170	JENNISON-WRIGHT CORP.	7,450.00	0.0166%	\$6,325.94		\$500.00	\$6,325.94	\$9,320.78	\$11,815.01
171	JARESS TRUCK CENTERS	7,350.00	0.0164%	\$6,241.03		\$500.00	\$6,241.03	\$9,202.38	\$11,663.73
172	BOOS, A. A. AND SONS, INC.	7,200.00	0.0161%	\$6,113.66		\$500.00	\$6,113.66	\$9,024.78	\$11,435.90
173	GROSS AUTOMOTIVE, INC.	7,200.00	0.0161%	\$6,113.66		\$500.00	\$6,113.66	\$9,024.78	\$11,435.90
174	SHELLER-GLOBE CORPORATION	7,165.00	0.0160%	\$6,083.95		\$500.00	\$6,083.95	\$8,983.34	\$11,382.74
175	FERRY CAP & SET SCREW CO.	7,100.00	0.0159%	\$6,028.75		\$500.00	\$6,028.75	\$8,908.38	\$11,284.01
176	DONALDSON FORD, INC.	7,048.00	0.0158%	\$5,984.60		\$500.00	\$5,984.60	\$8,844.81	\$11,205.03

RANK	RESPONSIBLE PARTY	VOLUME (Gallons)	PERCENT	PROJECTED TOTAL SHARE	PREVIOUS PAYMENTS	PHASE I TIME VALUE ASSESSMENT	PROJECTED SHARE NET PREVIOUS PAYMENTS	CAPPED DE MINIMIS	DE MINIMIS
177	NORTHWOOD CHRYSLER	7,025.00	0.0157%	\$5,965.07		\$500.00	\$5,965.07	\$8,817.58	\$11,170.09
178	SMITH, W. E. & SONS, INC.	6,950.00	0.0155%	\$5,901.38		\$500.00	\$5,901.38	\$8,728.78	\$11,058.18
179	CITY MACHINE AND TOOL	6,800.00	0.0152%	\$5,774.02		\$500.00	\$5,774.02	\$8,551.18	\$10,828.35
180	SEARS ROEBUCK & CO.	6,729.00	0.0150%	\$5,713.73		\$500.00	\$5,713.73	\$8,467.12	\$10,720.51
181	ABBEE ETNA MACHINE CO.	6,725.00	0.0150%	\$5,710.33		\$500.00	\$5,710.33	\$8,462.38	\$10,714.43
182	CARDON CORPORATION	6,700.00	0.0150%	\$5,689.10		\$500.00	\$5,689.10	\$8,432.78	\$10,676.40
183	TAG CHEMICALS, INC.	6,601.00	0.0148%	\$5,605.04		\$500.00	\$5,605.04	\$8,315.57	\$10,526.09
184	CURTIS HOMES, INC.	6,500.00	0.0145%	\$5,519.28		\$500.00	\$5,519.28	\$8,195.98	\$10,372.68
185	TERMINAL TRANSPORT CO., INC.	6,500.00	0.0145%	\$5,519.28		\$500.00	\$5,519.28	\$8,195.98	\$10,372.68
186	ARXON COMPANY	6,440.00	0.0144%	\$5,468.33		\$500.00	\$5,468.33	\$8,124.94	\$10,281.55
187	WAYNESFIELD CONSTRUCTION, INC.	6,267.00	0.0140%	\$5,321.44		\$500.00	\$5,321.44	\$7,920.11	\$10,018.79
188	AMERICAN METAL CLEANING, INC.	6,250.00	0.0140%	\$5,307.00		\$500.00	\$5,307.00	\$7,899.98	\$9,992.97
189	PACKAGING CORPORATION OF AMERICA	6,120.00	0.0137%	\$5,196.61		\$500.00	\$5,196.61	\$7,748.08	\$9,795.51
190	BLISSFIELD MANUFACTURING	6,030.00	0.0135%	\$5,120.19		\$500.00	\$5,120.19	\$7,639.50	\$9,658.81
191	WILLIAM FERREL, INC.	5,927.00	0.0132%	\$5,032.73		\$500.00	\$5,032.73	\$7,517.55	\$9,502.37
192	MAUMEE VALLEY DODGE	5,888.00	0.0132%	\$4,999.62		\$500.00	\$4,999.62	\$7,471.38	\$9,443.13
193	BERNARD ENGRAVING CO.	5,880.00	0.0131%	\$4,992.83		\$500.00	\$4,992.83	\$7,461.90	\$9,430.98
194	VAN HUFFEL TUBE CORPORATION	5,732.50	0.0128%	\$4,867.58		\$500.00	\$4,867.58	\$7,287.28	\$9,208.95
195	LEASCO INC.	5,640.00	0.0126%	\$4,789.04		\$500.00	\$4,789.04	\$7,177.74	\$9,066.45
196	SHELL SERVICE STATION	5,450.00	0.0122%	\$4,627.70		\$500.00	\$4,627.70	\$6,952.79	\$8,777.87
197	TAYLOR BUICK, INC.	5,445.00	0.0122%	\$4,623.46		\$500.00	\$4,623.46	\$6,948.87	\$8,770.27
198	PFIZER INC.	5,300.00	0.0118%	\$4,500.34		\$500.00	\$4,500.34	\$6,775.19	\$8,550.03
199	MAUMEE LINCOLN - MERCURY INC.	5,255.00	0.0117%	\$4,462.13		\$500.00	\$4,462.13	\$6,721.91	\$8,481.69
200	PUREX CORPORATION	5,250.00	0.0117%	\$4,457.88		\$500.00	\$4,457.88	\$6,715.99	\$8,474.09
201	DUVALL & PIZIO, INC.	5,200.00	0.0116%	\$4,415.42		\$500.00	\$4,415.42	\$6,656.79	\$8,398.15
202	CLARK OIL & REFINING CORPORATION	5,150.00	0.0115%	\$4,372.97		\$500.00	\$4,372.97	\$6,597.59	\$8,322.20
203	MILLER, BILL FORD	5,113.00	0.0114%	\$4,341.55		\$500.00	\$4,341.55	\$6,553.78	\$8,266.01
204	TOM'S TIRE & AUTO SERVICE (GOODYEAR)	5,100.00	0.0114%	\$4,330.51		\$500.00	\$4,330.51	\$6,538.39	\$8,246.28
205	TOLEDO BLADE COMPANY	5,090.00	0.0114%	\$4,322.02		\$500.00	\$4,322.02	\$6,526.55	\$8,231.07
206	MEILINK SAFE COMPANY	5,062.00	0.0113%	\$4,298.25		\$500.00	\$4,298.25	\$6,493.39	\$8,188.54
207	ATECH CHEMICAL COATINGS	5,035.00	0.0113%	\$4,275.32	\$2,068.18		\$2,209.14	\$3,895.24	\$5,581.35
208	COMMERCIAL OIL SERVICE	5,000.00	0.0112%	\$4,245.60		\$500.00	\$4,245.60	\$6,419.99	\$8,094.37
209	SMITH, ALLEN A. CO.	5,000.00	0.0112%	\$4,245.60		\$500.00	\$4,245.60	\$6,419.99	\$8,094.37
210	MCNEIL CHEVROLET, INC.	4,840.00	0.0108%	\$4,109.74		\$500.00	\$4,109.74	\$6,230.55	\$7,851.35
211	MID - AMERICA CHEMICAL CORPORATION	4,795.00	0.0107%	\$4,071.53		\$500.00	\$4,071.53	\$6,177.27	\$7,783.00
212	MID - VALLEY PIPELINE COMPANY	4,753.00	0.0106%	\$4,035.87		\$500.00	\$4,035.87	\$6,127.54	\$7,719.21
213	LAKEPORT VW	4,730.00	0.0106%	\$4,016.34		\$500.00	\$4,016.34	\$6,100.31	\$7,684.28
214	MIKOLAS, ALAN	4,700.00	0.0105%	\$3,990.88		\$500.00	\$3,990.88	\$6,084.79	\$7,638.71
215	TOLEDO GENERATOR SERVICE, INC.	4,614.50	0.0103%	\$3,918.26		\$500.00	\$3,918.26	\$5,963.56	\$7,508.85
216	BUCKEYE ALUMINUM EXTRUSION	4,600.00	0.0103%	\$3,905.95		\$500.00	\$3,905.95	\$5,948.39	\$7,486.82
217	TRANSAMERICAN FREIGHT LINES	4,500.00	0.0101%	\$3,821.04		\$500.00	\$3,821.04	\$5,827.99	\$7,334.94
218	PLACID REFINING CO.	4,465.00	0.0100%	\$3,791.32		\$500.00	\$3,791.32	\$5,786.55	\$7,281.77
219	ROTH MOTOR SALES	4,464.00	0.0100%	\$3,790.47		\$500.00	\$3,790.47	\$5,785.36	\$7,280.26
220	INTERSTATE TRUCK & EQUIPMENT SERV., INC	4,450.00	0.0099%	\$3,778.58		\$500.00	\$3,778.58	\$5,768.79	\$7,258.99

RANK	RESPONSIBLE PARTY	VOLUME (Gallons)	PERCENT	PROJECTED TOTAL SHARE	PREVIOUS PAYMENTS	PHASE I TIME VALUE ASSESSMENT	PROJECTED SHARE NET PREVIOUS PAYMENTS	CAPPED DE MINIMIS	DE MINIMIS
221	UNITED STATES COAST GUARD	4,435.00	0.0099%	\$3,765.85		\$500.00	\$3,765.85	\$5,751.03	\$7,236.21
222	PRESTO-EVERLOCK	4,400.00	0.0098%	\$3,736.13		\$500.00	\$3,736.13	\$5,709.59	\$7,183.05
223	WEST POINTE CHRYSLER	4,350.00	0.0097%	\$3,693.67		\$500.00	\$3,693.67	\$5,650.39	\$7,107.10
224	OREGON, OHIO, CITY OF	4,320.00	0.0097%	\$3,668.20		\$500.00	\$3,668.20	\$5,614.87	\$7,061.54
225	KASLE IRON AND METALS	4,317.00	0.0096%	\$3,665.65		\$500.00	\$3,665.65	\$5,611.32	\$7,056.98
226	DUNBAR MECHANICAL INCORPORATED	4,286.00	0.0096%	\$3,639.33		\$500.00	\$3,639.33	\$5,574.61	\$7,009.00
227	MODINE MANUFACTURING COMPANY	4,250.00	0.0095%	\$3,608.78		\$500.00	\$3,608.78	\$5,531.99	\$6,955.22
228	B & P WRECKING CO., INC.	4,200.00	0.0094%	\$3,566.30		\$500.00	\$3,566.30	\$5,472.79	\$6,879.27
229	SHERWIN METAL RECLAIMING COMPANY	4,125.00	0.0092%	\$3,502.62		\$500.00	\$3,502.62	\$5,383.99	\$6,765.36
230	PENN ALUMINUM	4,100.00	0.0092%	\$3,481.39		\$500.00	\$3,481.39	\$5,354.39	\$6,727.39
231	PIERCE CONSTRUCTION	4,100.00	0.0092%	\$3,481.39		\$500.00	\$3,481.39	\$5,354.39	\$6,727.39
232	JOHNNY'S CITGO SERVICE STATION	4,000.00	0.0089%	\$3,396.48		\$500.00	\$3,396.48	\$5,235.99	\$6,575.50
233	WARNER & SWASEY CO., INC.	4,000.00	0.0089%	\$3,396.48		\$500.00	\$3,396.48	\$5,235.99	\$6,575.50
234	WOLVERINE PIPE LINE COMPANY	3,900.00	0.0087%	\$3,311.57		\$500.00	\$3,311.57	\$5,117.59	\$6,423.61
235	MARATHON GAS STATION	3,899.00	0.0087%	\$3,310.72		\$500.00	\$3,310.72	\$5,116.41	\$6,422.09
236	JONES TRANSFER COMPANY	3,875.00	0.0087%	\$3,290.34		\$500.00	\$3,290.34	\$5,087.99	\$6,385.64
237	EATON CORPORATION	3,830.00	0.0086%	\$3,252.13		\$500.00	\$3,252.13	\$5,034.71	\$6,317.29
238	DENNIS, WILL VW	3,795.00	0.0085%	\$3,222.41		\$500.00	\$3,222.41	\$4,993.27	\$6,264.13
239	SUNOCO SERVICE STATION	3,747.00	0.0084%	\$3,181.65		\$500.00	\$3,181.65	\$4,936.44	\$6,191.22
240	MEYERS, PAUL CO.	3,700.00	0.0083%	\$3,141.74		\$500.00	\$3,141.74	\$4,880.79	\$6,119.84
241	HIGH VOLTAGE SYSTEMS, INC.	3,665.00	0.0082%	\$3,112.03		\$500.00	\$3,112.03	\$4,839.35	\$6,066.67
242	ERVIN AMASTEEL	3,650.00	0.0082%	\$3,099.29		\$500.00	\$3,099.29	\$4,821.59	\$6,043.89
243	DUNN CHEVY OLDS	3,645.00	0.0081%	\$3,095.04		\$500.00	\$3,095.04	\$4,815.67	\$6,036.30
244	MOBIL SERVICE STATION	3,619.00	0.0081%	\$3,072.97		\$500.00	\$3,072.97	\$4,784.89	\$5,996.81
245	LUTTRELL'S AUTO SUPPLY	3,615.00	0.0081%	\$3,069.57		\$500.00	\$3,069.57	\$4,780.15	\$5,990.73
246	INVERNESS CLUB	3,600.00	0.0080%	\$3,056.83		\$500.00	\$3,056.83	\$4,762.39	\$5,967.95
247	NELSON CRANE SERVICE	3,600.00	0.0080%	\$3,056.83		\$500.00	\$3,056.83	\$4,762.39	\$5,967.95
248	C-R TRAILER & BODY WORKS, INC.	3,500.00	0.0078%	\$2,971.92		\$500.00	\$2,971.92	\$4,643.99	\$5,816.06
249	YOUNG EQUIPMENT COMPANY, INC.	3,450.00	0.0077%	\$2,929.46		\$500.00	\$2,929.46	\$4,584.79	\$5,740.12
250	ALPHA TUBE CORPORATION	3,445.00	0.0077%	\$2,925.22		\$500.00	\$2,925.22	\$4,578.87	\$5,732.52
251	CLASSON, BUD CHEVROLET	3,410.00	0.0076%	\$2,895.50		\$500.00	\$2,895.50	\$4,537.43	\$5,679.38
252	CYCLONE REFINERY	3,400.00	0.0076%	\$2,887.01		\$500.00	\$2,887.01	\$4,525.59	\$5,664.17
253	VROMAN FOODS, INC.	3,300.00	0.0074%	\$2,802.10		\$500.00	\$2,802.10	\$4,407.19	\$5,512.29
254	WEBSTER MANUFACTURING CO.	3,200.00	0.0072%	\$2,717.18		\$500.00	\$2,717.18	\$4,288.79	\$5,360.40
255	LORRAINE OIL CO.	3,165.00	0.0071%	\$2,687.47		\$500.00	\$2,687.47	\$4,247.35	\$5,307.24
256	APEX TOWING	3,150.00	0.0070%	\$2,674.73		\$500.00	\$2,674.73	\$4,229.59	\$5,284.45
257	STOW/DAVIS FURNITURE COMPANY	3,135.00	0.0070%	\$2,661.99		\$500.00	\$2,661.99	\$4,211.83	\$5,261.67
258	E & L TRANSPORT COMPANY	3,100.00	0.0069%	\$2,632.27		\$500.00	\$2,632.27	\$4,170.39	\$5,208.51
259	ESCOR	3,100.00	0.0069%	\$2,632.27		\$500.00	\$2,632.27	\$4,170.39	\$5,208.51
260	HALL'S MOTOR TRANSIT COMPANY	3,100.00	0.0069%	\$2,632.27		\$500.00	\$2,632.27	\$4,170.39	\$5,208.51
261	FRANKLIN PARK LINCOLN MERCURY, INC.	3,050.00	0.0068%	\$2,589.82		\$500.00	\$2,589.82	\$4,111.19	\$5,132.57
262	BUDD COMPANY	3,000.00	0.0067%	\$2,547.36		\$500.00	\$2,547.36	\$4,051.99	\$5,056.62
263	GROSS ELECTRIC CO.	3,000.00	0.0067%	\$2,547.36		\$500.00	\$2,547.36	\$4,051.99	\$5,056.62
264	LEE'S SALE & SERVICE	3,000.00	0.0067%	\$2,547.36		\$500.00	\$2,547.36	\$4,051.99	\$5,056.62

RANK	RESPONSIBLE PARTY	VOLUME (Gallons)	PERCENT	PROJECTED TOTAL SHARE	PREVIOUS PAYMENTS	PHASE I TIME VALUE ASSESSMENT	PROJECTED SHARE NET PREVIOUS PAYMENTS	CAPPED DE MINIMIS	DE MINIMIS
265	PARKLANE HOTEL	3,000.00	0.0067%	\$2,547.36		\$500.00	\$2,547.36	\$4,051.99	\$5,056.02
266	UNIVERSITY OF TOLEDO	3,000.00	0.0067%	\$2,547.36		\$500.00	\$2,547.36	\$4,051.99	\$5,056.62
267	SAGINAW WIRE CO.	2,955.00	0.0066%	\$2,509.15		\$500.00	\$2,509.15	\$3,998.71	\$4,988.27
268	JOHNSON'S SOHIO	2,925.00	0.0065%	\$2,483.68		\$500.00	\$2,483.68	\$3,963.19	\$4,942.71
269	GULF SERVICE STATION	2,918.00	0.0065%	\$2,477.73		\$500.00	\$2,477.73	\$3,954.90	\$4,932.06
270	ARCO BUILDERS, INC.	2,900.00	0.0065%	\$2,462.45		\$500.00	\$2,462.45	\$3,933.59	\$4,904.74
271	AAMCO AUTOMATIC TRANSMISSION	2,800.00	0.0063%	\$2,377.54		\$500.00	\$2,377.54	\$3,815.19	\$4,752.85
272	DUNDEE TRUCK LINES	2,760.00	0.0062%	\$2,343.57		\$500.00	\$2,343.57	\$3,767.83	\$4,692.09
273	BIG BARNEY AUTO WASH	2,700.00	0.0060%	\$2,292.62		\$500.00	\$2,292.62	\$3,696.79	\$4,600.96
274	HEINZ COMPANY	2,700.00	0.0060%	\$2,292.62		\$500.00	\$2,292.62	\$3,696.79	\$4,600.96
275	LAMBROS, JOHN L.	2,700.00	0.0060%	\$2,292.62		\$500.00	\$2,292.62	\$3,696.79	\$4,600.96
276	AI RESEARCH MFG. OF CALIF.	2,650.00	0.0059%	\$2,250.17		\$500.00	\$2,250.17	\$3,637.59	\$4,525.02
277	BRANCH TRUCKING	2,600.00	0.0058%	\$2,207.71		\$500.00	\$2,207.71	\$3,578.39	\$4,449.07
278	CHANNING SUNOCO	2,600.00	0.0058%	\$2,207.71		\$500.00	\$2,207.71	\$3,578.39	\$4,449.07
279	CONTINENTAL BAKING COMPANY	2,550.00	0.0057%	\$2,165.26		\$500.00	\$2,165.26	\$3,519.19	\$4,373.13
280	RELIANCE ELECTRIC	2,530.00	0.0057%	\$2,148.27		\$500.00	\$2,148.27	\$3,495.51	\$4,342.75
281	CUMMINS OHIO, INC.	2,500.00	0.0056%	\$2,122.80		\$500.00	\$2,122.80	\$3,459.99	\$4,297.19
282	STATE LINE AUTO PARTS	2,500.00	0.0056%	\$2,122.80		\$500.00	\$2,122.80	\$3,459.99	\$4,297.19
283	WACO OIL CO.	2,500.00	0.0056%	\$2,122.80		\$500.00	\$2,122.80	\$3,459.99	\$4,297.19
284	PAYLESS GAS STATION	2,462.00	0.0055%	\$2,090.53		\$500.00	\$2,090.53	\$3,415.00	\$4,239.47
285	HANNAH INLAND WATERWAYS	2,450.00	0.0055%	\$2,080.34		\$500.00	\$2,080.34	\$3,400.79	\$4,221.24
286	VALTON CHRYSLER-PLYMOUTH-IMPORTS	2,400.00	0.0054%	\$2,037.89		\$500.00	\$2,037.89	\$3,341.59	\$4,145.30
287	TESA CORPORATION	2,365.66	0.0053%	\$2,006.73		\$500.00	\$2,006.73	\$3,300.94	\$4,093.14
288	MAURER, BILL AND CO.	2,365.00	0.0053%	\$2,006.17		\$500.00	\$2,006.17	\$3,300.15	\$4,092.14
289	PERSTORP POLYOLS, INC.	2,310.00	0.0052%	\$1,961.47		\$500.00	\$1,961.47	\$3,235.03	\$4,008.60
290	MARK BODY	2,285.00	0.0051%	\$1,940.24		\$500.00	\$1,940.24	\$3,205.43	\$3,970.63
291	JANSON TOOL & DIE COMPANY	2,260.00	0.0051%	\$1,919.01		\$500.00	\$1,919.01	\$3,175.83	\$3,932.66
292	BURNBY	2,250.00	0.0050%	\$1,910.52		\$500.00	\$1,910.52	\$3,163.99	\$3,917.47
293	MACHINERY BUILDERS, INC.	2,250.00	0.0050%	\$1,910.52		\$500.00	\$1,910.52	\$3,163.99	\$3,917.47
294	HILTON TRUCK & EQUIPMENT CO.	2,200.00	0.0049%	\$1,868.06		\$500.00	\$1,868.06	\$3,104.79	\$3,841.52
295	NOLLENBERGER FORD, INC.	2,200.00	0.0049%	\$1,868.06		\$500.00	\$1,868.06	\$3,104.79	\$3,841.52
296	WOODERING UNION 78	2,200.00	0.0049%	\$1,868.06		\$500.00	\$1,868.06	\$3,104.79	\$3,841.52
297	UNITED STATES POST OFFICE MAIN BRANCH	2,130.00	0.0048%	\$1,806.63		\$500.00	\$1,806.63	\$3,021.91	\$3,735.20
298	PHILIPS 66	2,125.00	0.0047%	\$1,804.38		\$500.00	\$1,804.38	\$3,015.99	\$3,727.81
299	SHORTWAY LINES, INC.	2,115.00	0.0047%	\$1,795.89		\$500.00	\$1,795.89	\$3,004.15	\$3,712.42
300	AMERICAN KOYO CORPORATION	2,100.00	0.0047%	\$1,783.15		\$500.00	\$1,783.15	\$2,966.39	\$3,689.64
301	BE-KAN	2,100.00	0.0047%	\$1,783.15		\$500.00	\$1,783.15	\$2,966.39	\$3,689.64
302	NAPCO PLASTICS COMPANY	2,100.00	0.0047%	\$1,783.15		\$500.00	\$1,783.15	\$2,966.39	\$3,689.64
303	QUALITY QUARRIES	2,100.00	0.0047%	\$1,783.15		\$500.00	\$1,783.15	\$2,966.39	\$3,689.64
304	RED-YELLOW CAB COMPANY	2,100.00	0.0047%	\$1,783.15		\$500.00	\$1,783.15	\$2,966.39	\$3,689.64
305	WILSON BUILDERS, INC.	2,100.00	0.0047%	\$1,783.15		\$500.00	\$1,783.15	\$2,966.39	\$3,689.64
306	LAKE ERIE WIRE COMPANY	2,035.00	0.0045%	\$1,727.96		\$500.00	\$1,727.96	\$2,909.43	\$3,590.91
307	SANGAP ABRASIVES, INC.	2,035.00	0.0045%	\$1,727.96		\$500.00	\$1,727.96	\$2,909.43	\$3,590.91
308	EARLY AMOCO	2,025.00	0.0045%	\$1,719.47		\$500.00	\$1,719.47	\$2,897.59	\$3,575.72

RANK	RESPONSIBLE PARTY	VOLUME (Gallons)	PERCENT	PROJECTED TOTAL SHARE	PREVIOUS PAYMENTS	PHASE I TIME VALUE ASSESSMENT	PROJECTED SHARE NET PREVIOUS PAYMENTS	CAPPED DE MINIMIS	DE MINIMIS
309	QUICK STOP OIL CHANGE	2,015.00	0.0045%	\$1,710.98		\$500.00	\$1,710.98	\$2,885.75	\$3,560.53
310	BUCKEYE MACHINERY CO.	2,000.00	0.0045%	\$1,698.24		\$500.00	\$1,698.24	\$2,867.99	\$3,537.75
311	FLEXI-VAN TRUCK RENTAL	2,000.00	0.0045%	\$1,698.24		\$500.00	\$1,698.24	\$2,867.99	\$3,537.75
312	HI-LEVEL SHELL	2,000.00	0.0045%	\$1,698.24		\$500.00	\$1,698.24	\$2,867.99	\$3,537.75
313	STUDER BROS. SUNOCO	1,995.00	0.0045%	\$1,693.99		\$500.00	\$1,693.99	\$2,862.07	\$3,530.15
314	MCNEIL IMPLEMENT	1,980.00	0.0044%	\$1,681.28		\$500.00	\$1,681.28	\$2,844.31	\$3,507.37
315	STRAKA SERVICE STATION	1,975.00	0.0044%	\$1,677.01		\$500.00	\$1,677.01	\$2,838.39	\$3,499.78
316	DONALD'S SOHIO SERVICE	1,950.00	0.0044%	\$1,655.78		\$500.00	\$1,655.78	\$2,808.79	\$3,461.81
317	GARRETT'S SHELL	1,950.00	0.0044%	\$1,655.78		\$500.00	\$1,655.78	\$2,808.79	\$3,461.81
318	JOHNSON CONSTRUCTION COMPANY	1,900.00	0.0042%	\$1,613.33		\$500.00	\$1,613.33	\$2,749.59	\$3,385.86
319	STUMP, WELDON, E. & CO.	1,870.00	0.0042%	\$1,587.85		\$500.00	\$1,587.85	\$2,714.07	\$3,340.30
320	RANDY'S MOBIL AUTO SERVICE	1,825.00	0.0041%	\$1,549.64		\$500.00	\$1,549.64	\$2,660.80	\$3,271.95
321	AMETEK, EASTERN OPERATIONS	1,800.00	0.0040%	\$1,528.42		\$500.00	\$1,528.42	\$2,631.20	\$3,233.97
322	GIRKINS ELECTRIC CO.	1,800.00	0.0040%	\$1,528.42		\$500.00	\$1,528.42	\$2,631.20	\$3,233.97
323	WILLS TRUCKING, INC.	1,800.00	0.0040%	\$1,528.42		\$500.00	\$1,528.42	\$2,631.20	\$3,233.97
324	GULF STATES PAPER CORPORATION	1,760.00	0.0039%	\$1,494.45		\$500.00	\$1,494.45	\$2,583.84	\$3,173.22
325	LOCKWOOD PLASTICS	1,760.00	0.0039%	\$1,494.45		\$500.00	\$1,494.45	\$2,583.84	\$3,173.22
326	LANGE, DONALD MOBIL	1,725.00	0.0039%	\$1,464.73		\$500.00	\$1,464.73	\$2,542.40	\$3,120.00
327	NATIONAL LABS	1,705.00	0.0038%	\$1,447.75		\$500.00	\$1,447.75	\$2,518.72	\$3,089.68
328	STEVENS, GENE OLDS	1,705.00	0.0038%	\$1,447.75		\$500.00	\$1,447.75	\$2,518.72	\$3,089.68
329	SWS SILICONES	1,705.00	0.0038%	\$1,447.75		\$500.00	\$1,447.75	\$2,518.72	\$3,089.68
330	DOYLE, PAT MOTOR SALES	1,700.00	0.0038%	\$1,443.50		\$500.00	\$1,443.50	\$2,512.80	\$3,082.09
331	UNITED PARCEL SERVICE	1,685.00	0.0038%	\$1,430.77		\$500.00	\$1,430.77	\$2,495.04	\$3,059.30
332	SWANTON CHRYSLER PLYMOUTH, INC.	1,666.00	0.0037%	\$1,414.63		\$500.00	\$1,414.63	\$2,472.54	\$3,030.44
333	ACKERMAN, GEORGE F. CO.	1,650.00	0.0037%	\$1,401.05		\$500.00	\$1,401.05	\$2,453.60	\$3,006.14
334	JENNE AMOCO	1,650.00	0.0037%	\$1,401.05		\$500.00	\$1,401.05	\$2,453.60	\$3,006.14
335	MIDWEST CONSTRUCTION CO., INC.	1,650.00	0.0037%	\$1,401.05		\$500.00	\$1,401.05	\$2,453.60	\$3,006.14
336	TOLEDO TRUCK REPAIR	1,650.00	0.0037%	\$1,401.05		\$500.00	\$1,401.05	\$2,453.60	\$3,006.14
337	HANSEN, N. M. COMPANY OF TOLEDO, OHIO	1,620.00	0.0036%	\$1,375.57		\$500.00	\$1,375.57	\$2,418.08	\$2,960.58
338	SOUTHLAND CORP (7-ELEVEN FOOD STORE)	1,601.00	0.0036%	\$1,359.44		\$500.00	\$1,359.44	\$2,395.58	\$2,931.72
339	AMERICAN STEAMSHIP CO.	1,600.00	0.0036%	\$1,358.59		\$500.00	\$1,358.59	\$2,394.40	\$2,930.20
340	BELLI, TONY MOTOR SALES	1,600.00	0.0036%	\$1,358.59		\$500.00	\$1,358.59	\$2,394.40	\$2,930.20
341	FAUNCE & FAUNCE, INC.	1,600.00	0.0036%	\$1,358.59		\$500.00	\$1,358.59	\$2,394.40	\$2,930.20
342	HARMON CHEVROLET	1,600.00	0.0036%	\$1,358.59		\$500.00	\$1,358.59	\$2,394.40	\$2,930.20
343	LAKESIDE WRECKING	1,600.00	0.0036%	\$1,358.59		\$500.00	\$1,358.59	\$2,394.40	\$2,930.20
344	TOLEDO MOLDING & DIE	1,600.00	0.0036%	\$1,358.59		\$500.00	\$1,358.59	\$2,394.40	\$2,930.20
345	DONNELLY MIRRORS	1,595.00	0.0036%	\$1,354.35		\$500.00	\$1,354.35	\$2,388.48	\$2,922.60
346	HAAS SOHIO	1,587.00	0.0035%	\$1,347.55		\$500.00	\$1,347.55	\$2,379.00	\$2,910.45
347	RYDER TRUCK	1,587.00	0.0035%	\$1,347.55		\$500.00	\$1,347.55	\$2,379.00	\$2,910.45
348	MORIARTY, HOWARD CO.	1,550.00	0.0035%	\$1,316.14		\$500.00	\$1,316.14	\$2,335.20	\$2,854.26
349	PIPE MACHINERY	1,550.00	0.0035%	\$1,316.14		\$500.00	\$1,316.14	\$2,335.20	\$2,854.26
350	TRILBY AUTOMOTIVE	1,550.00	0.0035%	\$1,316.14		\$500.00	\$1,316.14	\$2,335.20	\$2,854.26
351	LIQUID AIR CORP.	1,537.50	0.0034%	\$1,305.52		\$500.00	\$1,305.52	\$2,320.40	\$2,835.27
352	BUNDY BROS.	1,500.00	0.0034%	\$1,273.68		\$500.00	\$1,273.68	\$2,278.00	\$2,778.31

RANK	RESPONSIBLE PARTY	VOLUME (Gallons)	PERCENT	PROJECTED TOTAL SHARE	PREVIOUS PAYMENTS	PHASE I TIME VALUE ASSESSMENT	PROJECTED SHARE NET PREVIOUS PAYMENTS	CAPPED DE MINIMIS	DE MINIMIS
353	C&W TANK CLEANING	1,500.00	0.0034%	\$1,273.68		\$500.00	\$1,273.68	\$2,276.00	\$2,778.31
354	LINVER-KRIPKE, INC.	1,500.00	0.0034%	\$1,273.68		\$500.00	\$1,273.68	\$2,276.00	\$2,778.31
355	MASON TIRE CO.	1,500.00	0.0034%	\$1,273.68		\$500.00	\$1,273.68	\$2,276.00	\$2,778.31
356	PANHANDLE EASTERN PIPE LINE COMPANY	1,500.00	0.0034%	\$1,273.68		\$500.00	\$1,273.68	\$2,276.00	\$2,778.31
357	STONY RIDGE SOHIO	1,500.00	0.0034%	\$1,273.68		\$500.00	\$1,273.68	\$2,276.00	\$2,778.31
358	KEYLINE AIR FREIGHT	1,485.00	0.0033%	\$1,260.94		\$500.00	\$1,260.94	\$2,258.24	\$2,755.53
359	SEAWAY FOODTOWN	1,460.00	0.0033%	\$1,239.72		\$500.00	\$1,239.72	\$2,228.84	\$2,717.50
360	MILLER, ROGER FORD	1,440.00	0.0032%	\$1,222.73		\$500.00	\$1,222.73	\$2,204.96	\$2,687.16
361	ERIE TOWNSHIP FIRE DEPT.	1,400.00	0.0031%	\$1,188.77		\$500.00	\$1,188.77	\$2,157.60	\$2,626.42
362	ROESH, WILLIAM R.	1,400.00	0.0031%	\$1,188.77		\$500.00	\$1,188.77	\$2,157.60	\$2,626.42
363	SCHULLER, ARTHUR J.	1,400.00	0.0031%	\$1,188.77		\$500.00	\$1,188.77	\$2,157.60	\$2,626.42
364	WALT'S AUTO SERVICE	1,400.00	0.0031%	\$1,188.77		\$500.00	\$1,188.77	\$2,157.60	\$2,626.42
365	CITY AUTO STAMPING CO.	1,375.00	0.0031%	\$1,167.54		\$500.00	\$1,167.54	\$2,128.00	\$2,588.45
366	KIEMLE-HANKINS COMPANY	1,375.00	0.0031%	\$1,167.54		\$500.00	\$1,167.54	\$2,128.00	\$2,588.45
367	LEN BEACH ASSOCIATES, INC.	1,375.00	0.0031%	\$1,167.54		\$500.00	\$1,167.54	\$2,128.00	\$2,588.45
368	OVERNITE TRANSPORTATION COMPANY	1,375.00	0.0031%	\$1,167.54		\$500.00	\$1,167.54	\$2,128.00	\$2,588.45
369	WAGNER, KEN SUNOCO	1,365.00	0.0031%	\$1,159.05		\$500.00	\$1,159.05	\$2,116.16	\$2,573.26
370	PAN AMERICAN CHEMICAL CORP.	1,360.00	0.0030%	\$1,154.80		\$500.00	\$1,154.80	\$2,110.24	\$2,565.67
371	CROUSE, H. L. CONSTRUCTION	1,350.00	0.0030%	\$1,148.31		\$500.00	\$1,148.31	\$2,098.40	\$2,550.48
372	DETROIT AND TOLEDO SHORE LINE RR. CO.	1,320.00	0.0030%	\$1,120.84		\$500.00	\$1,120.84	\$2,062.88	\$2,504.91
373	GARRETT AIR RESEARCH	1,300.00	0.0029%	\$1,103.86		\$500.00	\$1,103.86	\$2,039.20	\$2,474.54
374	JUHASZ, JAMES	1,300.00	0.0029%	\$1,103.86		\$500.00	\$1,103.86	\$2,039.20	\$2,474.54
375	MEDICAL COLLEGE OF OHIO	1,300.00	0.0029%	\$1,103.86		\$500.00	\$1,103.86	\$2,039.20	\$2,474.54
376	WHITEHOUSE TRUCK STOP	1,300.00	0.0029%	\$1,103.86		\$500.00	\$1,103.86	\$2,039.20	\$2,474.54
377	EDDY'S GAS & OIL	1,295.00	0.0029%	\$1,099.61		\$500.00	\$1,099.61	\$2,033.28	\$2,466.04
378	COCA-COLA BOTTLING COMPANY	1,235.00	0.0028%	\$1,048.68		\$500.00	\$1,048.68	\$1,982.24	\$2,375.81
379	SOHIO OIL CO.	1,225.00	0.0027%	\$1,040.17		\$500.00	\$1,040.17	\$1,950.40	\$2,360.82
380	NATIONAL BELTING	1,210.00	0.0027%	\$1,027.44		\$500.00	\$1,027.44	\$1,932.64	\$2,337.84
381	ITT ABRASIVE	1,200.00	0.0027%	\$1,018.94		\$500.00	\$1,018.94	\$1,920.80	\$2,322.65
382	PERRYSBURG COLLISION SERVICE	1,200.00	0.0027%	\$1,018.94		\$500.00	\$1,018.94	\$1,920.80	\$2,322.65
383	GREAT LAKES TOWING COMPANY	1,155.00	0.0026%	\$980.73		\$500.00	\$1,000.00	\$1,867.52	\$2,254.30
384	CHEMLAWN SERVICES CORPORATION	1,150.00	0.0026%	\$976.49		\$500.00	\$1,000.00	\$1,881.60	\$2,246.71
385	MILLER AUTOMOTIVE LEASING CO.	1,140.00	0.0025%	\$968.00		\$500.00	\$1,000.00	\$1,849.76	\$2,231.52
386	CARROLL & PENNY MOTORS	1,139.00	0.0025%	\$967.15		\$500.00	\$1,000.00	\$1,848.57	\$2,230.00
387	WHITE, JIM COMPANY	1,110.00	0.0025%	\$942.52		\$500.00	\$1,000.00	\$1,814.24	\$2,185.95
388	HEATHERDOWNS AUTO SERVICE	1,100.00	0.0025%	\$934.03		\$500.00	\$1,000.00	\$1,802.40	\$2,170.76
389	MARTIN'S GULF	1,100.00	0.0025%	\$934.03		\$500.00	\$1,000.00	\$1,802.40	\$2,170.76
390	PROFESSIONAL AUTO SERVICE	1,100.00	0.0025%	\$934.03		\$500.00	\$1,000.00	\$1,802.40	\$2,170.76
391	SCHMIDT LEASE, INC.	1,100.00	0.0025%	\$934.03		\$500.00	\$1,000.00	\$1,802.40	\$2,170.76
392	STUTZMAN FORD SALES, INC.	1,100.00	0.0025%	\$934.03		\$500.00	\$1,000.00	\$1,802.40	\$2,170.76
393	UPPER FARM SERVICE	1,100.00	0.0025%	\$934.03		\$500.00	\$1,000.00	\$1,802.40	\$2,170.76
394	ATLAS CAR & MFG. CO.	1,045.00	0.0023%	\$887.33		\$500.00	\$1,000.00	\$1,737.28	\$2,087.22
395	BRYANS AUTOMOTIVE	1,000.00	0.0022%	\$849.12		\$500.00	\$1,000.00	\$1,684.00	\$2,018.87
396	BUCKEYE NATIONAL CASKET, INC.	1,000.00	0.0022%	\$849.12		\$500.00	\$1,000.00	\$1,684.00	\$2,018.87

RANK	RESPONSIBLE PARTY	VOLUME (Gallons)	PERCENT	PROJECTED TOTAL SHARE	PREVIOUS PAYMENTS	PHASE I TIME VALUE ASSESSMENT	PROJECTED SHARE NET PREVIOUS PAYMENTS	CAPPED DE MINIMIS	DE MINIMIS
397	COYOTES	1,000.00	0.0022%	\$849.12		\$500.00	\$1,000.00	\$1,684.00	\$2,018.87
398	CRAGER, FRED CONSTRUCTION	1,000.00	0.0022%	\$849.12		\$500.00	\$1,000.00	\$1,684.00	\$2,018.87
399	CUMMINS DIESEL OF NORTHERN OHIO, INC.	1,000.00	0.0022%	\$849.12		\$500.00	\$1,000.00	\$1,684.00	\$2,018.87
400	GOFF, BOB	1,000.00	0.0022%	\$849.12		\$500.00	\$1,000.00	\$1,684.00	\$2,018.87
401	LAING, JAMES AND SON	1,000.00	0.0022%	\$849.12		\$500.00	\$1,000.00	\$1,684.00	\$2,018.87
402	NORTHWEST PETROLEUM	1,000.00	0.0022%	\$849.12		\$500.00	\$1,000.00	\$1,684.00	\$2,018.87
403	RUCH CONSTRUCTION CO.	1,000.00	0.0022%	\$849.12		\$500.00	\$1,000.00	\$1,684.00	\$2,018.87
404	SHOOKS SOHIO	1,000.00	0.0022%	\$849.12		\$500.00	\$1,000.00	\$1,684.00	\$2,018.87
405	SMITHERS SUNOCO	1,000.00	0.0022%	\$849.12		\$500.00	\$1,000.00	\$1,684.00	\$2,018.87
408	SPARTAN CHEMICAL	1,000.00	0.0022%	\$849.12		\$500.00	\$1,000.00	\$1,684.00	\$2,018.87
407	WHITMER HIGH SCHOOL	1,000.00	0.0022%	\$849.12		\$500.00	\$1,000.00	\$1,684.00	\$2,018.87
408	WOOD COUNTY GARAGE	1,000.00	0.0022%	\$849.12		\$500.00	\$1,000.00	\$1,684.00	\$2,018.87
409	KEL-MAR & ASSOCIATES	990.00	0.0022%	\$840.63		\$500.00	\$1,000.00	\$1,672.16	\$2,003.69
410	TOLEDO-LUCAS CO. PUBLIC LIBRARY	990.00	0.0022%	\$840.63		\$500.00	\$1,000.00	\$1,672.16	\$2,003.69
411	HAWTHORNE AMC	975.00	0.0022%	\$827.89		\$500.00	\$1,000.00	\$1,654.40	\$1,980.90
412	HERTZ PENSKE TRUCK LEASING, INC.	973.00	0.0022%	\$826.19		\$500.00	\$1,000.00	\$1,652.03	\$1,977.86
413	ANTHONY WAYNE LOCAL SCHOOLS	955.00	0.0021%	\$810.91		\$500.00	\$1,000.00	\$1,630.72	\$1,950.53
414	AIRCO INDUSTRIAL GASES	950.00	0.0021%	\$806.66		\$500.00	\$1,000.00	\$1,624.80	\$1,942.93
415	AMERICAN CUSTOM INDUSTRIES	950.00	0.0021%	\$806.66		\$500.00	\$1,000.00	\$1,624.80	\$1,942.93
416	B&L AUTO SERVICE	950.00	0.0021%	\$806.66		\$500.00	\$1,000.00	\$1,624.80	\$1,942.93
417	RAMONS SHELL	950.00	0.0021%	\$806.66		\$500.00	\$1,000.00	\$1,624.80	\$1,942.93
418	SAMSEL SERVICES COMPANY	950.00	0.0021%	\$806.66		\$500.00	\$1,000.00	\$1,624.80	\$1,942.93
419	MIDAS MUFFLER SERVICE CENTERS	935.00	0.0021%	\$793.93		\$500.00	\$1,000.00	\$1,607.04	\$1,920.15
420	KISTLER FORD INC.	910.00	0.0020%	\$772.70		\$500.00	\$1,000.00	\$1,577.44	\$1,882.18
421	BARRY EQUIPMENT	900.00	0.0020%	\$764.21		\$500.00	\$1,000.00	\$1,565.60	\$1,866.99
422	BOB'S MARATHON	900.00	0.0020%	\$764.21		\$500.00	\$1,000.00	\$1,565.60	\$1,866.99
423	CARGILL, INC.	900.00	0.0020%	\$764.21		\$500.00	\$1,000.00	\$1,565.60	\$1,866.99
424	LANDMARK TANK TRANSPORT	900.00	0.0020%	\$764.21		\$500.00	\$1,000.00	\$1,565.60	\$1,866.99
425	BRONZE, MARKEY	880.00	0.0020%	\$747.23		\$500.00	\$1,000.00	\$1,541.92	\$1,836.61
426	B&P TRUCKING CO.	880.00	0.0020%	\$747.23		\$500.00	\$1,000.00	\$1,541.92	\$1,836.61
427	GLASSTECH, INC.	880.00	0.0020%	\$747.23		\$500.00	\$1,000.00	\$1,541.92	\$1,836.61
428	LEBLANC CADILLAC	850.00	0.0019%	\$721.75		\$500.00	\$1,000.00	\$1,506.40	\$1,791.04
429	MASSEY FERGUSON	850.00	0.0019%	\$721.75		\$500.00	\$1,000.00	\$1,506.40	\$1,791.04
430	OHIO DEPARTMENT OF TRANSPORTATION	850.00	0.0019%	\$721.75		\$500.00	\$1,000.00	\$1,506.40	\$1,791.04
431	WRIGHT SUNOCO	850.00	0.0019%	\$721.75		\$500.00	\$1,000.00	\$1,506.40	\$1,791.04
432	STRONG ELECTRIC CO.	835.00	0.0019%	\$709.02		\$500.00	\$1,000.00	\$1,500.00	\$1,768.26
433	ASTRO AVIATION	825.00	0.0018%	\$700.52		\$500.00	\$1,000.00	\$1,500.00	\$1,753.07
434	EISENHOUR MOTOR SALES, INC.	825.00	0.0018%	\$700.52		\$500.00	\$1,000.00	\$1,500.00	\$1,753.07
435	GAS APPLIANCE	825.00	0.0018%	\$700.52		\$500.00	\$1,000.00	\$1,500.00	\$1,753.07
436	SMITH FURNITURE, INC.	825.00	0.0018%	\$700.52		\$500.00	\$1,000.00	\$1,500.00	\$1,753.07
437	TOLEDO METAL SPINNING CO.	825.00	0.0018%	\$700.52		\$500.00	\$1,000.00	\$1,500.00	\$1,753.07
438	AMOCO SERVICE	800.00	0.0018%	\$679.30		\$500.00	\$1,000.00	\$1,500.00	\$1,715.10
439	DONNELLY, H. H. & ASSOCIATES	800.00	0.0018%	\$679.30		\$500.00	\$1,000.00	\$1,500.00	\$1,715.10
440	EXPER TUNE	800.00	0.0018%	\$679.30		\$500.00	\$1,000.00	\$1,500.00	\$1,715.10

RANK	RESPONSIBLE PARTY	VOLUME (Gallons)	PERCENT	PROJECTED TOTAL SHARE	PREVIOUS PAYMENTS	PHASE I TIME VALUE ASSESSMENT	PROJECTED SHARE NET PREVIOUS PAYMENTS	CAPPED DE MINIMIS	DE MINIMIS
441	FACET FUEL SYSTEMS, INC.	800.00	0.0018%	\$679.30		\$500.00	\$1,000.00	\$1,500.00	\$1,715.10
442	GAULT'S ARCO SERVICE STATION	800.00	0.0018%	\$679.30		\$500.00	\$1,000.00	\$1,500.00	\$1,715.10
443	JIL'S CORPORATION	800.00	0.0018%	\$679.30		\$500.00	\$1,000.00	\$1,500.00	\$1,715.10
444	MEROLLIS, GRENE	800.00	0.0018%	\$679.30		\$500.00	\$1,000.00	\$1,500.00	\$1,715.10
445	MUNICIPAL UTILITIES	800.00	0.0018%	\$679.30		\$500.00	\$1,000.00	\$1,500.00	\$1,715.10
446	PETRO POINT CAR WASH RE: LYDEN OIL	800.00	0.0018%	\$679.30		\$500.00	\$1,000.00	\$1,500.00	\$1,715.10
447	KRIPKE - TUSCHMAN IND. INC.	777.00	0.0017%	\$659.77		\$500.00	\$1,000.00	\$1,500.00	\$1,680.17
448	FIELDS SUNOCO	775.00	0.0017%	\$658.07		\$500.00	\$1,000.00	\$1,500.00	\$1,877.13
449	BABCOCK & WILCOX CO.	770.00	0.0017%	\$653.82		\$500.00	\$1,000.00	\$1,500.00	\$1,669.53
450	BENTLEY, A. & SONS COMPANY	770.00	0.0017%	\$653.82		\$500.00	\$1,000.00	\$1,500.00	\$1,669.53
451	KERN TRUCK SALES	770.00	0.0017%	\$653.82		\$500.00	\$1,000.00	\$1,500.00	\$1,669.53
452	SPILKERS	770.00	0.0017%	\$653.82		\$500.00	\$1,000.00	\$1,500.00	\$1,669.53
453	SYNCO	770.00	0.0017%	\$653.82		\$500.00	\$1,000.00	\$1,500.00	\$1,669.53
454	SUBURBAN MOTOR FREIGHT, INC.	751.00	0.0017%	\$637.69		\$500.00	\$1,000.00	\$1,500.00	\$1,640.67
455	FIRESTONE TIRESTORE	750.00	0.0017%	\$636.84		\$500.00	\$1,000.00	\$1,500.00	\$1,639.16
456	LINDERME TUBE CO., THE	750.00	0.0017%	\$636.84		\$500.00	\$1,000.00	\$1,500.00	\$1,639.16
457	LUTHERAN HOUSING SERVICES, INC.	750.00	0.0017%	\$636.84		\$500.00	\$1,000.00	\$1,500.00	\$1,639.16
458	RUDOLPH LIBBE, INC.	750.00	0.0017%	\$636.84		\$500.00	\$1,000.00	\$1,500.00	\$1,639.16
459	V & S TRUCKING, INC.	750.00	0.0017%	\$636.84		\$500.00	\$1,000.00	\$1,500.00	\$1,639.16
460	QUASI, INC.	729.00	0.0016%	\$619.01		\$500.00	\$1,000.00	\$1,500.00	\$1,607.26
461	GREENWOOD CHEVROLET	720.00	0.0016%	\$611.37		\$500.00	\$1,000.00	\$1,500.00	\$1,593.59
462	ROBINAIR DIVISION	715.00	0.0016%	\$607.12		\$500.00	\$1,000.00	\$1,500.00	\$1,506.00
463	GOODYEAR TIRE & RUBBER/MOTOR WHEEL	712.50	0.0016%	\$605.00		\$500.00	\$1,000.00	\$1,500.00	\$1,582.20
464	COLUMBIA LNG CORPORATION	700.00	0.0016%	\$594.38		\$500.00	\$1,000.00	\$1,500.00	\$1,563.21
465	LANGE, DONALD AMOCO	700.00	0.0016%	\$594.38		\$500.00	\$1,000.00	\$1,500.00	\$1,563.21
466	PEPSICO TRUCK RENTAL, INC.	700.00	0.0016%	\$594.38		\$500.00	\$1,000.00	\$1,500.00	\$1,563.21
467	TABOR, ED	700.00	0.0016%	\$594.38		\$500.00	\$1,000.00	\$1,500.00	\$1,563.21
468	TOLEDO SPRINGS	700.00	0.0016%	\$594.38		\$500.00	\$1,000.00	\$1,500.00	\$1,563.21
469	LEIGH PRODUCTS	698.80	0.0016%	\$593.37		\$500.00	\$1,000.00	\$1,500.00	\$1,561.39
470	OTTAWA GULF	667.00	0.0015%	\$566.36		\$500.00	\$1,000.00	\$1,500.00	\$1,513.09
471	ST. CLAIR METAL PRODUCT	662.65	0.0015%	\$562.67		\$500.00	\$1,000.00	\$1,500.00	\$1,506.46
472	CONTINENTAL COFFEE PRODUCTS CO.	660.00	0.0015%	\$560.42		\$500.00	\$1,000.00	\$1,500.00	\$1,502.46
473	DISHOP FORD YUGO NISSAN, INC.	660.00	0.0015%	\$560.42		\$500.00	\$1,000.00	\$1,500.00	\$1,502.46
474	TOLEDO HEATER CO.	660.00	0.0015%	\$560.42		\$500.00	\$1,000.00	\$1,500.00	\$1,502.46
475	BOHL EQUIPMENT COMPANY	650.00	0.0015%	\$551.93		\$500.00			\$1,487.27
476	GREISER FORD	650.00	0.0015%	\$551.93		\$500.00			\$1,487.27
477	MAYBERRY'S TRUCK & AUTO SERVICE INC.	650.00	0.0015%	\$551.93		\$500.00			\$1,487.27
478	ARCO SERVICE	625.00	0.0014%	\$530.70		\$500.00			\$1,449.30
479	LEHMAN CARTAGE	625.00	0.0014%	\$530.70		\$500.00			\$1,449.30
480	PENNEY, J.C. CO.	625.00	0.0014%	\$530.70		\$500.00			\$1,449.30
481	RON'S MARATHON	625.00	0.0014%	\$530.70		\$500.00			\$1,449.30
482	BOWLING GREEN JAYCEES	600.00	0.0013%	\$509.47		\$500.00			\$1,411.32
483	DEGRISKY, CHUCK SUNOCO	600.00	0.0013%	\$509.47		\$500.00			\$1,411.32
484	DRIGGS DAIRY	600.00	0.0013%	\$509.47		\$500.00			\$1,411.32

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485	DURR INDUSTRIES, INC.	600.00	0.0013%	\$509.47		\$500.00			\$1,411.32
486	GRABEN STETTLER MOTOR SALES	600.00	0.0013%	\$509.47		\$500.00			\$1,411.32
487	HOLLAND INDUSTRIES	600.00	0.0013%	\$509.47		\$500.00			\$1,411.32
488	VAROUK OIL CO.	600.00	0.0013%	\$509.47		\$500.00			\$1,411.32
489	Q & H METAL PRODUCTS, INC.	590.00	0.0013%	\$500.98		\$500.00			\$1,398.14
490	TOLEDO SIGN	580.00	0.0013%	\$492.49		\$500.00			\$1,380.95
491	ILLEGIBLE	578.00	0.0013%	\$490.79		\$500.00			\$1,377.01
492	NEWMARK, ABE SOHIO	575.00	0.0013%	\$488.24		\$500.00			\$1,373.35
493	SPURGEON-CHEVROLET MOTOR SALES, INC.	562.00	0.0013%	\$477.21		\$500.00			\$1,353.61
494	AIR PRODUCTS & CHEMICALS	550.00	0.0012%	\$467.02		\$500.00			\$1,335.38
495	ART'S AUTO SERVICE	550.00	0.0012%	\$467.02		\$500.00			\$1,335.38
496	CEDAR POINT THE AMAZEMENT PARK	550.00	0.0012%	\$467.02		\$500.00			\$1,335.38
497	CHAMPION PACKAGES COMPANY	550.00	0.0012%	\$467.02		\$500.00			\$1,335.38
498	CLEARR INDUSTRIES	550.00	0.0012%	\$467.02		\$500.00			\$1,335.38
499	FOSTORIA AUTO & TRUCK	550.00	0.0012%	\$467.02		\$500.00			\$1,335.38
500	GRANDVIEW GULF	550.00	0.0012%	\$467.02		\$500.00			\$1,335.38
501	MICHIGAN STONE	550.00	0.0012%	\$467.02		\$500.00			\$1,335.38
502	MID-STATES TERMINALS, INC.	550.00	0.0012%	\$467.02		\$500.00			\$1,335.38
503	PLUMB'S SOHIO	550.00	0.0012%	\$467.02		\$500.00			\$1,335.38
504	POINT PLACE 78	550.00	0.0012%	\$467.02		\$500.00			\$1,335.38
505	SCHICK'S, DON MARATHON	550.00	0.0012%	\$467.02		\$500.00			\$1,335.38
506	WESTSIDE FUEL	550.00	0.0012%	\$467.02		\$500.00			\$1,335.38
507	DALE'S OLDS SOHIO	525.00	0.0012%	\$445.79		\$500.00			\$1,297.41
508	DIRECT MARKETING	525.00	0.0012%	\$445.79		\$500.00			\$1,297.41
509	LUCAS, COUNTY OF	510.00	0.0011%	\$433.05		\$500.00			\$1,274.63
510	RAY AND DON'S UNION 78	510.00	0.0011%	\$433.05		\$500.00			\$1,274.63
511	AERO BOX	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
512	BAFIA'S SUNOCO	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
513	BERTOK BROS. GULF	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
514	CORVETTE'S SUNOCO	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
515	ELTON'S UNION 78	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
516	EMT	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
517	EXOTHURMICS	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
518	HENNINGER, RUTH	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
519	JEFF'S AUTO SERVICE	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
520	KAIGHIN HUGHES	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
521	MARTIN, BERNICE	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
522	MCLEAN TRUCKING	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
523	MERCY HOSPITAL	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
524	MIDWEST HAULERS	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
525	MILT WAGNER CHEVROLET	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
526	REDISTRIP OF TOLEDO	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
527	SAND CREEK SCHOOL BUS GARAGE	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
528	SOCIE, TOM	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44

RANK	RESPONSIBLE PARTY	VOLUME (Gallons)	PERCENT	PROJECTED TOTAL SHARE	PREVIOUS PAYMENTS	PHASE I TIME VALUE ASSESSMENT	PROJECTED SHARE NET PREVIOUS PAYMENTS	CAPPED DE MINIMIS	DE MINIMIS
529	STREICHER, H. P. INC.	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
530	TRANSCON LINES TRUCKING	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
531	VILLAGE SOHIO	500.00	0.0011%	\$424.56		\$500.00			\$1,259.44
532	U. S. STANDARD SIGN	495.00	0.0011%	\$420.31		\$500.00			\$1,251.84
533	OHIO DIESEL TECHNICAL INSTITUTE	480.00	0.0011%	\$407.58		\$500.00			\$1,229.00
534	COMMERCIAL LOVELACE MOTOR FREIGHT, IN	475.00	0.0011%	\$403.33		\$500.00			\$1,221.47
535	WHITMAN FORD	475.00	0.0011%	\$403.33		\$500.00			\$1,221.47
536	TRIANGLE GARAGE	465.00	0.0010%	\$394.84		\$500.00			\$1,200.28
537	ROMAN MANUFACTURING, INC.	464.58	0.0010%	\$394.48		\$500.00			\$1,205.64
538	BI-STATE FORD TRUCK SALES, INC.	450.00	0.0010%	\$382.10		\$500.00			\$1,183.49
539	DAN'S TRUCK REFRIGERATION	450.00	0.0010%	\$382.10		\$500.00			\$1,183.49
540	HARRINGTON CHEVROLET CADILLAC CO.	450.00	0.0010%	\$382.10		\$500.00			\$1,183.49
541	JOHNICK TRUCKING COMPANY	450.00	0.0010%	\$382.10		\$500.00			\$1,183.49
542	LANGENDERFER	450.00	0.0010%	\$382.10		\$500.00			\$1,183.49
543	NATIONAL TRANSIT CORPORATION	450.00	0.0010%	\$382.10		\$500.00			\$1,183.49
544	OLD SOHIO	450.00	0.0010%	\$382.10		\$500.00			\$1,183.49
545	PHIL'S UNION 76	450.00	0.0010%	\$382.10		\$500.00			\$1,183.49
546	POTTER'S SUNOCO	450.00	0.0010%	\$382.10		\$500.00			\$1,183.49
547	RIDEOUT POWER	450.00	0.0010%	\$382.10		\$500.00			\$1,183.49
548	THERMAL ENGINEERING CO.	450.00	0.0010%	\$382.10		\$500.00			\$1,183.49
549	WEINRICH SOHIO	450.00	0.0010%	\$382.10		\$500.00			\$1,183.49
550	BUSSFIELD GULF	435.00	0.0010%	\$369.37		\$500.00			\$1,160.71
551	GLASS CITY DODGE	425.00	0.0009%	\$360.88		\$500.00			\$1,145.52
552	BOLLEY MOTOR SALES, INC.	410.00	0.0009%	\$348.14		\$500.00			\$1,122.74
553	AUTOMETRIC OF ROYAL OAK	405.00	0.0009%	\$343.89		\$500.00			\$1,115.14
554	BAILEY IMPLEMENT CO.	400.00	0.0009%	\$339.65		\$500.00			\$1,107.55
555	CHANDLER PRODUCTS	400.00	0.0009%	\$339.65		\$500.00			\$1,107.55
556	CHUCK OF KAWASKI OF TOLEDO	400.00	0.0009%	\$339.65		\$500.00			\$1,107.55
557	DELTA TIRE CENTER	400.00	0.0009%	\$339.65		\$500.00			\$1,107.55
558	GLORE WAYNE TRUCKING	400.00	0.0009%	\$339.65		\$500.00			\$1,107.55
559	KELLER CHEVROLET, INC.	400.00	0.0009%	\$339.65		\$500.00			\$1,107.55
560	KNAPP CHEVROLET OLDSMOBILE PONTIAC BU	400.00	0.0009%	\$339.65		\$500.00			\$1,107.55
561	MCLAUGHLIN'S CAR CARE	400.00	0.0009%	\$339.65		\$500.00			\$1,107.55
562	MIKOLAS, TERRY	400.00	0.0009%	\$339.65		\$500.00			\$1,107.55
563	NORTHWEST MECHANICAL CONTRACTORS	400.00	0.0009%	\$339.65		\$500.00			\$1,107.55
564	NORTHWESTERN DODGE, INC.	400.00	0.0009%	\$339.65		\$500.00			\$1,107.55
565	OTTAWA SUNOCO	400.00	0.0009%	\$339.65		\$500.00			\$1,107.55
566	STADIUM VIEW SUNOCO	400.00	0.0009%	\$339.65		\$500.00			\$1,107.55
567	TANK MOTOR SALES	400.00	0.0009%	\$339.65		\$500.00			\$1,107.55
568	WALT'S MARATHON	400.00	0.0009%	\$339.65		\$500.00			\$1,107.55
569	WELLS, KENNETH	400.00	0.0009%	\$339.65		\$500.00			\$1,107.55
570	WHITNEY SHELL	400.00	0.0009%	\$339.65		\$500.00			\$1,107.55
571	ZELIN, BOB	400.00	0.0009%	\$339.65		\$500.00			\$1,107.55
572	IDEAL SEAL CO.	385.00	0.0009%	\$326.91		\$500.00			\$1,084.77

RANK	RESPONSIBLE PARTY	VOLUME (Gallons)	PERCENT	PROJECTED TOTAL SHARE	PREVIOUS PAYMENTS	PHASE I TIME VALUE ASSESSMENT	PROJECTED SHARE NET PREVIOUS PAYMENTS	CAPPED DE MINIMIS	DE MINIMIS
573	WOODARD, STOWE	385.00	0.0009%	\$326.91		\$500.00			\$1,084.77
574	BUDGET TRANSMISSION	375.00	0.0008%	\$318.42		\$500.00			\$1,069.58
575	COLUMBIA GAS OF OHIO	375.00	0.0008%	\$318.42		\$500.00			\$1,069.58
576	K-MART CORPORATION	375.00	0.0008%	\$318.42		\$500.00			\$1,069.58
577	PRICES'S SUNOCO	375.00	0.0008%	\$318.42		\$500.00			\$1,069.58
578	UNIFIED INDUSTRIES	364.46	0.0008%	\$309.47		\$500.00			\$1,053.57
579	CROZIER MOTORS, INC.	350.00	0.0008%	\$297.19		\$500.00			\$1,031.61
580	EVERETT, DON PONTIAC COMPANY	350.00	0.0008%	\$297.19		\$500.00			\$1,031.61
581	FALCON AERONAUTICAL, INC.	350.00	0.0008%	\$297.19		\$500.00			\$1,031.61
582	NEWARK SOHIO	350.00	0.0008%	\$297.19		\$500.00			\$1,031.61
583	ROMP FARM SALES	350.00	0.0008%	\$297.19		\$500.00			\$1,031.61
584	TALER, SAM	350.00	0.0008%	\$297.19		\$500.00			\$1,031.61
585	TRAILWAYS LINES, INC.	350.00	0.0008%	\$297.19		\$500.00			\$1,031.61
586	WILLIAMS, W. W.	350.00	0.0008%	\$297.19		\$500.00			\$1,031.61
587	FORT MEIGS AUTO SALES	340.00	0.0008%	\$288.70		\$500.00			\$1,018.42
588	TRUESDELL GMC TRUCK, INC.	335.00	0.0007%	\$284.48		\$500.00			\$1,008.82
589	FALVEY OF TROY	330.00	0.0007%	\$280.21		\$500.00			\$1,001.23
590	GONZALES EXCAVATING CO.	330.00	0.0007%	\$280.21		\$500.00			\$1,001.23
591	NORTH AMERICAN CAR CORP.	330.00	0.0007%	\$280.21		\$500.00			\$1,001.23
592	REITZ TOOL & DIE, INC.	330.00	0.0007%	\$280.21		\$500.00			\$1,001.23
593	STEWART, GIBSON	330.00	0.0007%	\$280.21		\$500.00			\$1,001.23
594	TINNEY, R. W., INC.	330.00	0.0007%	\$280.21		\$500.00			\$1,001.23
595	TOLEDO TESTING LAB, INC.	330.00	0.0007%	\$280.21		\$500.00			\$1,001.23
596	NICHOLSON CONCRETE & SUPPLY CO.	320.00	0.0007%	\$271.72		\$500.00			\$1,000.00
597	ARBOR PLASTICS	300.00	0.0007%	\$254.74		\$500.00			-\$1,000.00
598	BOILERS CONTROLS & EQUIPMENT, INC.	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
599	BUCKEYE STAGES	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
600	BURKS TRUCKING	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
601	CHAPIN & CHAPIN	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
602	DANNY SULPHIN FORD	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
603	DENNY'S GULF	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
604	DREW CARTAGE, INC.	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
605	GTE	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
606	HAROLD'S SOHIO	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
607	HARRISON MARINA, LTD.	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
608	HARRISON MOTOR SALES	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
609	HARTSELL, JACK MARATHON	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
610	KIBSGARD LINCOLN MERCURY	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
611	LARRY'S GULF SERVICE	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
612	MAC'S MOTOR CLINIC	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
613	PATTON PONTIAC	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
614	PERKINS	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
615	RUBINI MOTORS	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
616	SMITH, WAYNE SUNOCO	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00

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617	SOHIO OIL COMPANY	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
618	ST. CATHERINES'S SCHOOL	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
619	SWANTON SCHOOL GARAGE	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
620	TOTAL WAREHOUSE	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
621	WOOLCO AUTOMOTIVE CENTER	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
622	YAWS SUNOCO	300.00	0.0007%	\$254.74		\$500.00			\$1,000.00
623	PARKER - HANMIFIN BRASS PRODUCTS	291.57	0.0007%	\$247.58		\$500.00			\$1,000.00
624	NORTHLAND COLLISION, INC.	280.00	0.0006%	\$237.75		\$500.00			\$1,000.00
625	DIECASTERS EQUIPMENT	275.00	0.0006%	\$233.51		\$500.00			\$1,000.00
626	GOOD DISPLAYS, INC.	275.00	0.0006%	\$233.51		\$500.00			\$1,000.00
627	INTERNATIONAL GREAT LAKES SHIPPING CO.	275.00	0.0006%	\$233.51		\$500.00			\$1,000.00
628	JURECK, ALLEN MARATHON	275.00	0.0006%	\$233.51		\$500.00			\$1,000.00
629	LOW SERVICE WATER PUMPING STATION	275.00	0.0006%	\$233.51		\$500.00			\$1,000.00
630	PEERLESS MOLDED PLASTICS, INC.	275.00	0.0006%	\$233.51		\$500.00			\$1,000.00
631	SIMS BUSINESS MACHINES	275.00	0.0006%	\$233.51		\$500.00			\$1,000.00
632	SUPERIOR TRANSFER CO.	275.00	0.0006%	\$233.51		\$500.00			\$1,000.00
633	THRONE AUTO SERVICE, INC.	275.00	0.0006%	\$233.51		\$500.00			\$1,000.00
634	ZIESLEP SUNOCO/GULF	275.00	0.0006%	\$233.51		\$500.00			\$1,000.00
635	CONSOLIDATED FREIGHTWAYS	270.00	0.0006%	\$229.28		\$500.00			\$1,000.00
636	WAYNE WIRE CLOTH PRODUCTS	265.06	0.0006%	\$225.07		\$500.00			\$1,000.00
637	GAGE OLDSMOBILE	265.00	0.0006%	\$225.02		\$500.00			\$1,000.00
638	B & B COLLISION	260.00	0.0006%	\$220.77		\$500.00			\$1,000.00
639	AUBURNDALE TRUCK	250.00	0.0006%	\$212.28		\$500.00			\$1,000.00
640	BAHNSEN & SONS SERVICE STATION	250.00	0.0006%	\$212.28		\$500.00			\$1,000.00
641	BUCKROW JOHN DEERE	250.00	0.0006%	\$212.28		\$500.00			\$1,000.00
642	CASCADE CHRYSLER-DODGE	250.00	0.0006%	\$212.28		\$500.00			\$1,000.00
643	CONGRESS MOBIL SERVICE	250.00	0.0006%	\$212.28		\$500.00			\$1,000.00
644	FOSTER CHEVY, INC.	250.00	0.0006%	\$212.28		\$500.00			\$1,000.00
645	FULTON COUNTY HWY. DEPT.	250.00	0.0006%	\$212.28		\$500.00			\$1,000.00
646	GITGOOD TRUCKING	250.00	0.0006%	\$212.28		\$500.00			\$1,000.00
647	J.C.'S RECYCLING CENTER	250.00	0.0006%	\$212.28		\$500.00			\$1,000.00
648	KASPER BUICK-GMC TRUCKS, INC.	250.00	0.0006%	\$212.28		\$500.00			\$1,000.00
649	MARTIN MOTOR SALES	250.00	0.0006%	\$212.28		\$500.00			\$1,000.00
650	MATHEWS FORD LINCOLN-MERCURY, INC.	250.00	0.0006%	\$212.28		\$500.00			\$1,000.00
651	RAYMOND FORD	250.00	0.0006%	\$212.28		\$500.00			\$1,000.00
652	SERVICE GARAGE, INC.	250.00	0.0006%	\$212.28		\$500.00			\$1,000.00
653	STROUB, TIM	250.00	0.0006%	\$212.28		\$500.00			\$1,000.00
654	UNDERWOOD AUTOMOTIVE	250.00	0.0006%	\$212.28		\$500.00			\$1,000.00
655	WESTGATE DODGE	250.00	0.0006%	\$212.28		\$500.00			\$1,000.00
656	TRONAIR	245.00	0.0005%	\$208.03		\$500.00			\$1,000.00
657	SUBURBAN OLDS	235.00	0.0005%	\$199.54		\$500.00			\$1,000.00
658	J. S. MARATHON	225.00	0.0005%	\$191.05		\$500.00			\$1,000.00
659	L & T AMC	225.00	0.0005%	\$191.05		\$500.00			\$1,000.00
660	AMERICAN TOOL & DIE, INC.	220.00	0.0005%	\$186.81		\$500.00			\$1,000.00

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661	BIEBESHEIMER MECHANICAL CONTRACTORS	220.00	0.0005%	\$188.81		\$500.00			\$1,000.00
662	B. F. GOODRICH TIRE CTRL	220.00	0.0005%	\$188.81		\$500.00			\$1,000.00
663	MIDTOWN AUTO SHOP	220.00	0.0005%	\$188.81		\$500.00			\$1,000.00
664	NAVAL ARMORY	220.00	0.0005%	\$188.81		\$500.00			\$1,000.00
665	TOLEDO MOLD COMPANY	220.00	0.0005%	\$188.81		\$500.00			\$1,000.00
666	MANISTER PLATING COMPANY	218.67	0.0005%	\$185.68		\$500.00			\$1,000.00
667	BUNDE, HARRY	200.00	0.0004%	\$169.82		\$500.00			\$1,000.00
668	B&R AUTO SERVICE	200.00	0.0004%	\$169.82		\$500.00			\$1,000.00
669	CHARLIE'S DODGE	200.00	0.0004%	\$169.82		\$500.00			\$1,000.00
670	EXPRESSWAY SOHIO	200.00	0.0004%	\$169.82		\$500.00			\$1,000.00
671	FIRESTONE	200.00	0.0004%	\$169.82		\$500.00			\$1,000.00
672	FREILANDS MOTOR CO.	200.00	0.0004%	\$169.82		\$500.00			\$1,000.00
673	HEUMS TRUCK LINE	200.00	0.0004%	\$169.82		\$500.00			\$1,000.00
674	LENAWEE FARM BUREAU	200.00	0.0004%	\$169.82		\$500.00			\$1,000.00
675	MCCOY'S MACK TRUCK	200.00	0.0004%	\$169.82		\$500.00			\$1,000.00
676	MILLER'S ARCO STATION	200.00	0.0004%	\$169.82		\$500.00			\$1,000.00
677	PASTOR, GARY CHEVROLET	200.00	0.0004%	\$169.82		\$500.00			\$1,000.00
678	PRESTON TRUCKING	200.00	0.0004%	\$169.82		\$500.00			\$1,000.00
679	REINHART SALES	200.00	0.0004%	\$169.82		\$500.00			\$1,000.00
680	SEOVAC	200.00	0.0004%	\$169.82		\$500.00			\$1,000.00
681	SHORELINE OIL CO.	200.00	0.0004%	\$169.82		\$500.00			\$1,000.00
682	SMITH, AL CHRYSLER-PLYMOUTH-DODGE, R	200.00	0.0004%	\$169.82		\$500.00			\$1,000.00
683	URBANSKI GARAGE	200.00	0.0004%	\$169.82		\$500.00			\$1,000.00
684	WACO GAS STATION	200.00	0.0004%	\$169.82		\$500.00			\$1,000.00
685	SECOR SHELL	175.00	0.0004%	\$148.60		\$500.00			\$1,000.00
686	STUDER'S SOHIO	175.00	0.0004%	\$148.60		\$500.00			\$1,000.00
687	WAGNER, E.S. CO.	175.00	0.0004%	\$148.60		\$500.00			\$1,000.00
688	ERIE MOLDING	165.00	0.0004%	\$140.10		\$500.00			\$1,000.00
689	RUAN LEASING	165.00	0.0004%	\$140.10		\$500.00			\$1,000.00
690	TROY COLLISION, INC.	165.00	0.0004%	\$140.10		\$500.00			\$1,000.00
691	ARKIE'S MARATHON	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00
692	AYRCO INVESTMENT CO. INC.	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00
693	BERGER, CHARLES	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00
694	BOWLING GREEN STATE UNIVERSITY	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00
695	FRED'S SUNOCO	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00
696	GETZ & ANDERSON	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00
697	LUCKEY AUTO SERVICE	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00
698	MARTIAN, LOUISE	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00
699	MAUMEE VALLEY MARATHON	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00
700	MCCOY'S SERVICE	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00
701	NEIDERHOUSE GULF	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00
702	OTTAWA RIVER YACHT CLUB	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00
703	PHIL'S MARATHON	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00
704	SCHADD'S MOBIL	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00

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705	SEDCO	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00
706	SHIPPERS DISPATCH	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00
707	TANSEL AMOCO	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00
708	TOLEDO PUBLIC SCHOOLS	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00
709	VW INC.	150.00	0.0003%	\$127.37		\$500.00			\$1,000.00
710	LILY-TULIP, INC.	137.00	0.0003%	\$116.33		\$500.00			\$1,000.00
711	AGRICULTURE CENTER (TOLEDO SCHOOLS)	125.00	0.0003%	\$106.14		\$500.00			\$1,000.00
712	NELSON, DEAN AMOCO	125.00	0.0003%	\$106.14		\$500.00			\$1,000.00
713	WALLACE WAREHOUSE	115.00	0.0003%	\$97.65		\$500.00			\$1,000.00
714	BUCKEYE MOBILE FOOD SERVICE	110.00	0.0002%	\$93.40		\$500.00			\$1,000.00
715	COMMERCIAL ALUMINUM COOKWARE CO.	110.00	0.0002%	\$93.40		\$500.00			\$1,000.00
716	FLYING BRIDGE RESTAURANT	110.00	0.0002%	\$93.40		\$500.00			\$1,000.00
717	LATTMAN RESIN	110.00	0.0002%	\$93.40		\$500.00			\$1,000.00
718	MT CLEMENS DODGE INC.	110.00	0.0002%	\$93.40		\$500.00			\$1,000.00
719	RECO CHEMICAL AND POOL CO., INC.	110.00	0.0002%	\$93.40		\$500.00			\$1,000.00
720	COFFEE SHOP	108.00	0.0002%	\$91.70		\$500.00			\$1,000.00
721	BRANDE MARINA	100.00	0.0002%	\$84.91		\$500.00			\$1,000.00
722	CASPER BUICK	100.00	0.0002%	\$84.91		\$500.00			\$1,000.00
723	ERIE CHRYSLER, PLYMOUTH, DODGE TRUCK	100.00	0.0002%	\$84.91		\$500.00			\$1,000.00
724	GREAT LAKES DIESEL CO.	100.00	0.0002%	\$84.91		\$500.00			\$1,000.00
725	HANCOCK LANDMARK, INC.	100.00	0.0002%	\$84.91		\$500.00			\$1,000.00
726	HENNISSE SUNOCO	100.00	0.0002%	\$84.91		\$500.00			\$1,000.00
727	INDUSTRIAL EQUIPMENT OF NO. OHIO, INC.	100.00	0.0002%	\$84.91		\$500.00			\$1,000.00
728	LEE'S GULF	100.00	0.0002%	\$84.91		\$500.00			\$1,000.00
729	LEE'S SUNOCO	100.00	0.0002%	\$84.91		\$500.00			\$1,000.00
730	LUNDY-VAN OLDS CADILLAC	100.00	0.0002%	\$84.91		\$500.00			\$1,000.00
731	OHIO IRON AND METALS	100.00	0.0002%	\$84.91		\$500.00			\$1,000.00
732	PRATERS HILLTOP GULF	100.00	0.0002%	\$84.91		\$500.00			\$1,000.00
733	ROSE MOTORS SALES, INC.	100.00	0.0002%	\$84.91		\$500.00			\$1,000.00
734	SHORELAND AUTOCARE/UNION 78	100.00	0.0002%	\$84.91		\$500.00			\$1,000.00
735	TOM'S AUTO SERVICE	100.00	0.0002%	\$84.91		\$500.00			\$1,000.00
736	TOM'S SOHIO	100.00	0.0002%	\$84.91		\$500.00			\$1,000.00
737	WILSON PONTIAC	100.00	0.0002%	\$84.91		\$500.00			\$1,000.00
738	WINSOR, TOM SOHIO	100.00	0.0002%	\$84.91		\$500.00			\$1,000.00
739	KELLY, EDWARD & SONS, INC.	90.00	0.0002%	\$76.42		\$500.00			\$1,000.00
740	TUFFY MUFFLER	90.00	0.0002%	\$76.42		\$500.00			\$1,000.00
741	RUTH, JACK H. CO.	80.00	0.0002%	\$67.93		\$500.00			\$1,000.00
742	DALE'S SHELL SERVICE	75.00	0.0002%	\$63.68		\$500.00			\$1,000.00
743	LICATA'S SUNOCO	75.00	0.0002%	\$63.68		\$500.00			\$1,000.00
744	SCHNEIDER'S FRAME & AXLE	75.00	0.0002%	\$63.68		\$500.00			\$1,000.00
745	NORTHLAND CHRYSLER-PLYMOUTH, INC.	65.00	0.0001%	\$55.19		\$500.00			\$1,000.00
746	D & T LIMOSINE SERVICE, INC.	55.00	0.0001%	\$46.70		\$500.00			\$1,000.00
747	HUSS EQUIPMENT CORP.	55.00	0.0001%	\$46.70		\$500.00			\$1,000.00
748	KOCH FISHERY	55.00	0.0001%	\$46.70		\$500.00			\$1,000.00

RANK	RESPONSIBLE PARTY	VOLUME (Gallons)	PERCENT	PROJECTED TOTAL SHARE	PREVIOUS PAYMENTS	PHASE I TIME VALUE ASSESSMENT	PROJECTED SHARE NET PREVIOUS PAYMENTS	CAPPED DE MINIMIS	DE MINIMIS
749	LO-TEMP BRAZING	55.00	0.0001%	\$46.70		\$500.00			\$1,000.00
750	MATCO	55.00	0.0001%	\$46.70		\$500.00			\$1,000.00
751	MICHAEL REALTY COMPANY	55.00	0.0001%	\$46.70		\$500.00			\$1,000.00
752	PLUMMER MOTOR SALES	55.00	0.0001%	\$46.70		\$500.00			\$1,000.00
753	SNETHCAMP, BILL INC.	55.00	0.0001%	\$46.70		\$500.00			\$1,000.00
754	SUZUKI	55.00	0.0001%	\$46.70		\$500.00			\$1,000.00
755	BOWLING GREEN LINCOLN MERCURY	50.00	0.0001%	\$42.46		\$500.00			\$1,000.00
756	BUD'S AUTO SERVICE	50.00	0.0001%	\$42.46		\$500.00			\$1,000.00
757	CHRISTOPHER CHRYSLER PLYMOUTH, INC.	50.00	0.0001%	\$42.46		\$500.00			\$1,000.00
758	FORD, STEPHEN	50.00	0.0001%	\$42.46		\$500.00			\$1,000.00
759	FRANK'S SUNOCO	50.00	0.0001%	\$42.46		\$500.00			\$1,000.00
760	HAMILTON, GENE CHEVEROLET, INC.	50.00	0.0001%	\$42.46		\$500.00			\$1,000.00
761	KLOSTER	50.00	0.0001%	\$42.46		\$500.00			\$1,000.00
762	M & S SUNOCO	50.00	0.0001%	\$42.46		\$500.00			\$1,000.00
763	MCDOLE'S, FRED GULF	50.00	0.0001%	\$42.46		\$500.00			\$1,000.00
764	MIKE'S STANDARD SERVICE	50.00	0.0001%	\$42.46		\$500.00			\$1,000.00
765	SUB-MARINE	50.00	0.0001%	\$42.46		\$500.00			\$1,000.00
766	TONY'S FRANKLIN PARK SUNOCO	50.00	0.0001%	\$42.46		\$500.00			\$1,000.00
767	TONY'S GULF	25.00	0.0001%	\$21.23		\$500.00			\$1,000.00
768	ABBOTT TRUCKING	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
769	AMBASSADOR MOTOR LODGE	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
770	AMERICAN MOTORS COMPANY	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
771	AMOS MOTOR & R.V.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
772	ARCO SERVICE STATION NAVARRE & PRENTIC	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
773	ARCO SERVICE STATION NEVADA & EAST BRO	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
774	BAILEY, KEITH OLDS	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
775	BAYVIEW TEXACO	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
776	BENTON VILLAGE SANITATION	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
777	BRABBLEE FARMS	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
778	BRADWELL, INC.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
779	BREAKER CARTAGE	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
780	BROADWAY WRECKING CO.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
781	BYERS SALES & SERVICE	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
782	CADILLAC & OLDS DEALERS	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
783	CENTRAL CATHOLIC HIGH SCHOOL	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
784	CITGO STATION	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
785	CLEVELAND-CLIFFS INC.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
786	CLOUTZMEIR MARVIN	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
787	COOK'S SOHIO STATION	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
788	DANKUTS SUNOCO	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
789	DAVIS METALS	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
790	DAYTON STEEL FOUNDRY CO.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
791	DEVAUL, KEN, INC.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
792	DICK'S SOHIO	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00

RANK	RESPONSIBLE PARTY	VOLUME (Gallons)	PERCENT	PROJECTED TOTAL SHARE	PREVIOUS PAYMENTS	PHASE I TIME VALUE ASSESSMENT	PROJECTED SHARE NET PREVIOUS PAYMENTS	CAPPED DE MINIMIS	DE MINIMIS
793	DISHLER IMPLEMENT	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
794	DUGAN, FLOYD CHEVROLET	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
795	DURICEK SHELL	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
796	D&K AUTOMOTIVE	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
797	EXPRESSWAY MOBIL	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
798	FEDERAL MOGUL CORP	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
799	GREEN THUMB PRODUCTS, INC.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
800	HEIDELBERG COLLEGE	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
801	HEINL GREENHOUSE	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
802	HERB & JOHN'S PURE SERVICE	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
803	HILL'S, BOB VOLKSWAGON	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
804	HYDERS GARAGE	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
805	J & G SALES	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
806	JERASS WHITE AUTOCAR	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
807	JERRY'S UNION 76	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
808	KEENE, JAMES F., INC.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
809	KEMP'S GULF STATION	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
810	KERN SODCO INC. ELECTRICAL CONTRACTOR	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
811	KLAUS OLDSMOBILE - CADILLAC, INC.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
812	LEVY, NORMAN ASSOCIATES, INC.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
813	LUEDTKE ENGINEERING COMPANY	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
814	MAUMEE CITY SCHOOLS	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
815	MCLEAN SINCLAIR	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
816	MCNERNEY AND SON, INC.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
817	MELLOCRAFT SUPPLY/HENRY J. SPIEKER COM	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
818	MOBIL OIL CO.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
819	MOTOR REBUILDERS AND PARTS, INC.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
820	OHIO SIGN SUPPLY	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
821	OLIVER SALES & SERVICE	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
822	O'ROURKE MOTOR SALES	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
823	PARKER, TOM GARAGE	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
824	PICKETT SUNOCO	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
825	POINT PLACE AMOCO SYC.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
826	QUIMBY MATERIAL HANDLING, INC.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
827	RAYMOND CHEMICAL CO.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
828	RISH EQUIPMENT COMPANY	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
829	SCHLAGETER-HALLET & ASSOC. INC.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
830	SCHULTZ SUNOCO	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
831	SERVICE MAINTENANCE SALES	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
832	SERVICE PRODUCTS BUILDINGS, INC.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
833	SHERWIN TRUCKING	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
834	SINCLAIR, G.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
835	SKUTMAN FORD	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
836	SONCRANT, ED	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00

RANK	RESPONSIBLE PARTY	VOLUME (Gallons)	PERCENT	PROJECTED TOTAL SHARE	PREVIOUS PAYMENTS	PHASE I TIME VALUE ASSESSMENT	PROJECTED SHARE NET PREVIOUS PAYMENTS	CAPPED DE MINIMIS	DE MINIMIS
837	STANDARD OIL STATION	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
838	ST. VINCENT MEDICAL CENTER	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
839	TAYLOR & SELLERS	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
840	TIM'S SOHIO	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
841	TOLEDO AUTOMOTIVE SCREW CO.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
842	TOLEDO TOWEL SUPPLY COMPANY	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
843	TONY SHEPHERD	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
844	URBAN GRADEL FUEL CO.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
845	VILLAGE FARM IN-OUT MART	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
846	VOLKSWAGON OF AMERICA, INC.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
847	WALLACE TRUCKING	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
848	WHEATON CARTAGE CO.	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
849	W.R. TRUCK STOP	0.00	0.0000%	\$0.00		\$500.00			\$1,000.00
	TOTALS	44,745,358.38	100.0000%	\$37,994,183.03	\$5,706,758.11	\$877,649.27	\$32,236,933.90	\$12,909,292.73	\$17,034,200.21

APPENDIX G

Attachment i

Appendix G is modified by the addition or volume modification for the following entities:

Gladieux Food Corporation	400 gals.
Gladieux Refinery, Inc.	110,720 gals.
Tony Licata	100 gals.
Olds Sohio	975 gals.
Point Place Amoco	125 gals.
Sherwin Metals Reclaiming Company	2,125 gals.
American Koyo Corporation	1,100 gals.
Purex Corporation	3,450 gals.
Polar Inc. (Indus. Petrol. & Amer. Tank)	20,276 gals.
Merce Industries Inc.	67,050 gals.
McNerny & Son/Wallace Trucking	0
American Chain & Cable Co., Inc.	152,100 gals.
Standard Products Co.	5,000 gals.
Toledo Auto Dealers Associate (TADA)	10,197 gals.
National Electrical Carbon Corporation	171,333 gals.
Union Carbide Corporation	45,270 gals.
Great Lakes Energy Systems	9,850 gals.
Great Lakes Environmental Service	3,000 gals.
James Wright	1,450 gals.
Waco Oil Co.	2,700 gals.
Woodville Quick Stop	1,075 gals.
Quickstop Oil Change	940 gals.
B.G. Jaycees Recycling	850 gals.
Trilby Automotive	100 gals.
Trilby Motors	1,450 gals.
Standard Oil Co.	1,298,294 gals.
Avery Internatinal	86,622 gals.
Donnelly Corporation	3,245 gals.
Volkswagon of America, Inc.	150 gals.
Sunstrand Corporation	86,828 gals.
Hubill Chemical Corporation	3,494 gals.
Fiske Brothers Refining Co.	253,518 gals.
Bridgestone/Firestone, Inc.	950 gals.
Union Oil of California	118,810 gals.
Shell Oil Company	17,798 gals.
RKO Bottlers of Toledo, Inc.	350 gals.
Pepsico Truck Rental, Inc.	350 gals.

APPENDIX G

Attachment 1

Appendix G is modified by the deletion of the following entries:

<u>No.</u>	<u>Note</u>
770 - American Motor	merged with Chrysler Motors Corporation
743 - Licata's Sunoco	merged into Tony Licata
767 - Tony's Gulf	merged into Tony Licata
507 - Dale Olds Sohio	merged into Olds Sohio
544 - Old Sohio	merged into Olds Sohio
712 - Nelson, Dean Amoco	merged into Point Place Amoco
431 - Wright Sunoco	merged into James Wright
566 - Stadium View Sunoco	merged into James Wright
670 - Expressway Sohio	merged into James Wright
684 - Waco Gas Station	merged into Waco Oil Co.
482 - Bowling Green Jaycees	merged into B.G. Jaycees Recycling
647 - J.C.'s Recycling Center	merged into B.G. Jaycees Recycling
141 - Sohio Station	merged into Standard Oil Co.
379 - Sohio Oil Co.	merged into Standard Oil Co.
617 - Sohio Oil Co.	merged into Standard Oil Co.
730 - Tom's Sohio	merged into Standard Oil Co.
837 - Standard Oil Station	merged into Standard Oil Co.
345 - Donnelly Mirrors	merged into Donnelly Corporation
724 - Great Lakes Diesel Co.	merged into Great Lakes Energy System
586 - W.W. Williams	merged into Great Lakes Energy System
709 - VW, Inc.	merged into Volkswagon of America, Inc.
671 - Firestone	merged into Bridgestone/Firestone, Inc.
455 - Firestone Tirestore	merged into Bridgestone/Firestone, Inc.
44 - Union Oil	merged into Union Oil of California
816 - McNerney & Son, Inc.	merged into McNerney & Son/Wallace Trucking
847 - Wallace Trucking	merged into McNerney & Son/Wallace Trucking

ATTACHMENT B
LIST OF ADDITIONAL INSURED

Attachment B

Trustees

Lisa Wurster, Dana Corporation
John Keil, Libbey-Owens-Ford Co.
Nelson Olavarria, Cooper Industries

Respondents

Allied Signal, Inc. (Allied Signal and Bendix Autolite)
American Metal Cleaning, Inc.
American Shipbuilding Company
FKI Industries, Inc. (American Chain and Cable Co., Inc.)
Beazer East, Inc. (Koppers Company, Inc.)
Black Equipment, Inc.
Brondes Motor Sales, Inc.
Brown Motor Sales Co.
Brush Wellman, Inc.
Chemcentral Corporation
Chrysler Corporation
Crown Cork and Seal Company, Inc.
Cooper Industries (Sharon Manufacturing and Champion Spark Plug Co.)
Dana Corporation
Doehler-Jarvis Castings (NL Industries, Inc.)
Epic Metals Corporation
Ferry Cap and Set Screw Co.
Fiske Brothers Refining Company
Ford Motor Company
General Motors Corporation
Tri Level, Inc. (Don Granger Car Wash)
Chevron U.S.A., Inc. (Gulf Oil Co.)
Hydro Aluminum Bohn (Gulf Western Metals)
Hunt-Wesson, Inc.
Safety-Kleen Envirosystems Company (Inland Chemical Corporation)
Interlake Corporation
Kelsey-Hayes Company
Latrobe Steel Company (Koncor Industries Division)
Libbey-Owens-Ford Co.
Lubrizol Corporation
Martin Marietta Corporation (Martin Marietta and Harvey Aluminum)
Borg Warner Corporation (Marvel/Schebler/Tillotson Division)
Matlack, Inc.
Merce Industries Incorporation
Metal Forge Company
Michigan Ohio-Pipeline (Total Petroleum, Inc.)

Nabisco Biscuit Co.
National Electrical Carbon Corporation
Ohio Edison Company
Owens-Illinois, Inc.
Peterson American Corporation
Roadway Express, Inc.
Safety-Kleen Corporation
Bob Schmidt Chevrolet, Inc.
Seneca Wire and Manufacturing Company
Shell Oil Company
BP America, Inc. (Standard Oil Company)
Sun Company, Inc. (Sun Oil Co.)
Sundstrand Corporation
Superior Overall Laundry Co.,
Tecumseh Products Company
Teledyne CAE
Centerior Energy Corporation (Toledo Edison Co.)
Toledo Generator Service
Union Oil Company of California (Unocal)
U.S. Reduction Co.
Westgate Auto Service, Inc. (Tom Tire and Auto)
Total Petroleum, Inc.
Ryder System, Inc. (Truckstops Corporation of America)
Whirlpool Corporation
Willson Builders, Inc.